PUBLIC HEALTH REPORTS

In this issue

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

I know not.

My time will not permit me at present, to make Remarks upon the whole, which however I shall take a convenient time for. And the World may expect a full Vindication of my self. For it is Truth and its Cause I am contending for, and therefore am not ashamed to fix my Name to it. I confess (using the Words of the famous Dr. *Lock*) the Imputation of Novelty is a terrible Charge amongst those who judge of mens Heads, as they

do of their Perukes by the fashion; and can allow none to be right but the received Doctrines. Truth scarce ever carried it by Vote any where at its first appearance: New Opinions are always suspected, and usually opposed, without any other reason, but because they are not already common. But Truth, like Gold, is not the less so, for being newly brought out of the Mine. 'Tis Trial and Examination must give it price, and not any Antick Fashion: And tho it be not yet Current by the Publick Stamp, yet it may for all that be as old as Nature, and is

is certainly not the less Genuine.

I did expect my Hypothesis would have been overthrown, and a better erected in its place, for which I should have thanked them; but instead of that, I find they have neither overthrown mine, nor erected a new one of their own, but have stood at a distance and barked at me, shewd their Teeth, but either durst not or could not come near enough to bite me in that place where I lay open to them. For in laying down an Hypothesis, it is as in building a House, no Man can be certain, that he which comes

PUBLIC HEALTH REPORTS

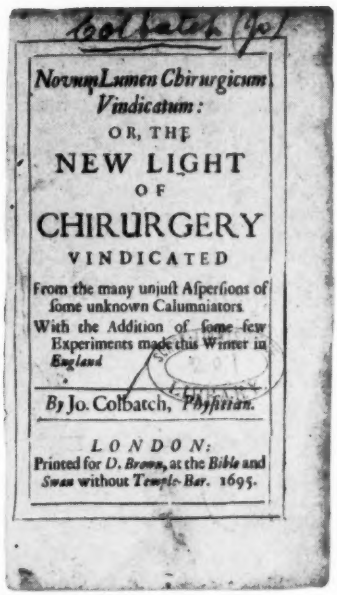
Volume 76 Number 7

JULY 1961

Published since 1878

CONTENTS

Continued ▶



Novum Lumen Chirurgicum Vindicatum:
OR, THE
NEW LIGHT
OF
CHIRURGERY
VINDICATED
From the many unjuſt Aſperſions of ſome unknown Calumniators
With the Addition of ſome few Experiments made this Winter in England
By Jo. Colbatch, Phyſitian.
LONDON:
Printed for D. Brown, at the Bible and Swan without Temple-Bar. 1695.

frontispiece

Above: Title page of Jo. Colbatch's *Novum Lumen Chirurgicum Vindicatum: or the New Light of Chirurgery Vindicated,* printed in London in 1695. *Opposite page:* Excerpt from pages 19–21. The original is in the collection of the History of Medicine Division, National Library of Medicine, Cleveland, Ohio.

PHR

SYNOPSES

CHIN, TOM D. Y. (Public Health Service), and MARINE, WILLIAM M.: ***The changing pattern of poliomyelitis observed in two urban epidemics, Kansas City and Des Moines, 1959. Public Health Reports, Vol. 76, July 1961, pp. 553–563.***

In 1959, major epidemics of type 1 poliomyelitis occurred in Des Moines, Iowa, and Kansas City, Mo. A total of 135 cases were reported in Des Moines, and 210 cases were reported in Kansas City. In both epidemics the majority of the cases occurred among Negroes and the poorer white residents in the center of the city. The poliomyelitis attack rate among Negroes in Des Moines was 20 times that of the upper white population; in Kansas City, the difference was 32-fold. In both epidemics the incidence was highest in children under 5 years; this was at variance with the age distribution observed in previous epidemics in these cities, when the rates were generally highest in the group 5–9 years.

The epidemiologic pattern observed in the 1959 epidemics was different from that of previous epidemics. The change appears to be related largely to the widespread use of the Salk vaccine during recent years.

Both the Des Moines and the Kansas City data indicate that the Salk-type vaccine was highly effective in protecting adequately immunized individuals against paralytic poliomyelitis. The efficacy was estimated to be 80 percent in the Des Moines study and 77 percent in the Kansas City study. The data suggest that high levels of vaccination might also have an influence on limiting the spread of poliovirus in the community.

EMMONS, CHESTER W. (Public Health Service): ***Isolation of Histoplasma capsulatum from soil in Washington, D.C. Public Health Reports, Vol. 76, July 1961, pp. 591–595.***

Histoplasma capsulatum was isolated from 10 of 10 soil specimens collected from a small, clean park adjacent to Pennsylvania Avenue NW., Washington, D.C., and from 1 of 5 specimens collected adjacent to another downtown Washington street. The first 10 isolations were from soil not obviously contaminated by bird droppings, but the soil specimens were taken under sycamore trees which are used as a roosting place by a large flock of starlings (*Sturnus vulgaris*).

This confirms, in a dramatic manner, the opinion already expressed by others, that roosting birds may play important roles in the epidemiology of urban histoplasmosis. It does not support the contention that pigeons are important in the maintenance of *H. capsulatum* in soil, although it has been well known since 1955 that virulent strains of *Cryptococcus neoformans* are commonly present in accumulations of pigeon droppings in both urban and rural areas.

CONTENTS *continued*

PUBLIC HEALTH REPORTS

Address correspondence to Executive Editor

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

ABRAHAM RIBICOFF, *Secretary*

PUBLIC HEALTH SERVICE

LUTHER L. TERRY, *Surgeon General*

PHR

SYNOPSES

WYLIE, CHARLES M. (Johns Hopkins University School of Hygiene and Public Health): *Participation in a multiple screening clinic with five-year followup. Public Health Reports, Vol. 76, July 1961, pp. 596–602.*

This study contrasts 2,023 screenees and a one-in-five sample of nonparticipants in the multiple screening clinic conducted in Baltimore in 1954 by the Commission on Chronic Illness. More recent information on these individuals was obtained from directories, by mail and telephone, and from death certificate files.

For the years 1955–59 more screenees than nonparticipants remained at the same address or moved to known addresses. Significantly more screenees than nonparticipants answered a questionnaire mailed in 1960.

Screenees and nonparticipants had similar age-specific death rates and showed similar trends in deaths for each year following screening. The two groups differed in the proportion of deaths from various causes. This mainly reflected their different age, race, and socioeconomic composition.

The death trends provided no evidence that screenees benefited greatly by their early referral for medical care; nor did the trends suggest that multiple screening attracted a group with significantly more or less of any particular disease than the nonparticipants.

Finally, the questionnaire returns suggested, though not conclusively, that screenees visited their physicians and were admitted to hospitals more frequently than nonparticipants.

SCHWIMMER, BENJAMIN (Detroit Department of Health), HENDERSON, NORMAN D., and OLSON, B. H.: *Treatment of acute gonorrhea in males with synnematin B. Public Health Reports, Vol. 76, July 1961, pp. 630-632.*

There is need for a new injectable antibiotic in the treatment of gonorrhea because of the rising problem of allergy to penicillin. Synnematin B, a new antibiotic, has been demonstrated to be effective in vitro against *Neisseria gonorrhoeae.*

A single injection of 300,000 units of synnematin B was employed in the treatment of each of 132 male patients with acute gonorrhea. No serious side effects or allergic reactions resulted. A 4 percent failure rate was observed.

Further study of the use of synnematin B in the treatment of gonorrhea is indicated.

Kansas City and Des Moines, 1959

The Changing Pattern of Poliomyelitis Observed in Two Urban Epidemics

TOM D. Y. CHIN, M.D., M.P.H., and WILLIAM M. MARINE, M.D.

IN 1959, two large epidemics of poliomyelitis occurred in the middle west, one in Des Moines, Iowa, and the other in Kansas City, Mo. The epidemiologic patterns of the two epidemics were similar. Essentially, they were characterized by a distinct geographic localization of cases, high attack rates in the lower socioeconomic segments of the population, with low incidence in the upper socioeconomic groups, and a preponderance of cases in unvaccinated children of preschool age.

The data presented in this paper indicate that the 1959 epidemics had an epidemiologic pattern different from that generally observed prior to the Salk vaccine era. The evidence derived from the Des Moines and Kansas City studies suggests that the altered epidemiologic pattern observed was related to the large-scale use of the Salk vaccine in recent years.

Materials and Methods

Both epidemics were extensively studied. A study team composed of personnel from the Communicable Disease Center, the Des Moines-Polk County Health Department, the Public Health Nurse Association, and the Iowa State Department of Health investigated the Des Moines cases; the nursing staff of the Kansas City (Mo.) Health Department investigated the Kansas City cases. The clinical and epidemiologic data were recorded on a standard form, which included the usual identifying information—date of onset of illness, vaccination status, clinical diagnosis, 60-day muscle evaluation, and the pertinent epidemiologic information. The hospital charts provided the clinical data, and the patients or their relatives supplied the epidemiologic data. The number of injections of Salk-type vaccine given up to 2 weeks before the onset of symptoms determined the vaccination status. The clinical classification was based on the presence or absence of significant muscle weakness at the time of the 60-day examination.

The investigations included extensive etiological studies. The specimens consisted of feces, either stools or rectal swabs, or both, and paired serums. In addition, throat washings were available on many of the Des Moines cases and on some of the Kansas City cases.

Virus isolations and identifications were performed in monkey kidney monolayer cultures. Poliomyelitis antibodies were measured by the complement fixation (CF) test, and antibodies for other enteroviruses were assayed by the neutralization test. Detailed descriptions of the methods appear elsewhere (*1–6*).

The vaccination status of the population was determined by household surveys conducted according to the methods described by Serfling and co-workers (*7*). Experienced statisticians in collaboration with local and State health department personnel supervised the surveys. Volunteers—Red Cross nurses, Gray Ladies, and Junior League members—performed the interviews in Des Moines; in Kansas City, in-

Dr. Chin is assistant chief of the Kansas City (Kans.) Field Station, and Dr. Marine is an officer of the Epidemic Intelligence Service, Communicable Disease Center, Public Health Service. *This paper was presented at the 88th annual meeting of the American Public Health Association, San Francisco, Calif., November 1, 1960.*

terviews were conducted by the city public health nurses, under the direction of Thomas C. Dundon, director, bureau of vital statistics, Missouri Department of Health. The vaccination levels determined were based on all vaccinations given up to June 1, 1959.

In 1959 Des Moines had a population of 203,100, including 192,800 whites and 10,300 Negroes. This estimate was made by the City Plan and Zoning Commission in January 1959. The 1952 and 1954 populations were derived by simple linear interpolation, using the 1959 estimate and the 1950 U.S. census. The age estimates were based on the 1950 U.S. census data except that the 1959 age estimates for persons under 21 years of age used the school census data of 1958. The 1950 census also provided data on socioeconomic classification of the population.

The population of Kansas City, Mo., estimated by the City Plan Commission survey in 1957, was 499,700. Of these, 381,500 were whites and 118,200 were Negroes. The 1957 survey also provided data on socioeconomic classification of the population. The 1959 vaccination survey provided the proportional age distribution for estimating the population in each age group. The 1950 census data were used to calculate the 1946 and 1952 rates.

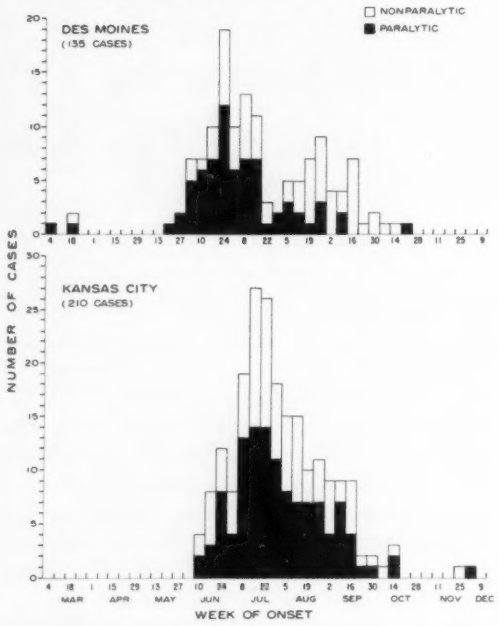
The proportion of Negroes in the Des Moines population remained stationary, while the percentage of Negroes in Kansas City had increased 1.7 times since 1950.

Clinical and Etiological Observations

During 1959, Des Moines had 135 cases of poliomyelitis; 70 were paralytic and 65 were nonparalytic. Four of the paralytic cases were fatal. An additional patient with bulbospinal paralysis died 10 months after onset of illness. Of the 135 patients, 102 were whites and 33 were Negroes, representing a specific rate of 52.9 and 320.4 per 100,000, respectively.

Virus isolations were attempted on fecal and throat specimens from 120 patients; 59 were paralytic, and 61 were nonparalytic. Poliovirus type 1 was recovered from 49 (83 percent) of the paralytic cases and from 19 (31 percent) of the nonparalytic cases. Nine patients with nonparalytic disease excreted a non-

Figure 1. Poliomyelitis cases in Des Moines, Iowa, and Kansas City, Mo., 1959, by week of onset and paralytic status



poliovirus; among them, one had ECHO virus type 7, two had Coxsackie B virus type 2, and the remaining six had unidentified agents. None of the patients harbored either type 2 or type 3 poliovirus.

Antibody studies were performed on paired serums of 31 patients; 28 did not have detectable virus in their feces or throat washings and 3 did not submit specimens for virus isolations. CF antibody response (fourfold or greater) to poliomyelitis was demonstrated in 13 patients—10 against type 1 and 3 against type 3; 2 of the 10 patients with type 1 antibody response also developed antibodies against other serotypes—one against type 2 and one against both types 2 and 3. Two additional patients developed neutralizing antibody against other enteroviruses—one against ECHO 7 and another against Coxsackie B2.

On the basis of these virus and antibody studies, 92 patients had enterovirus infections; 87 percent of them were associated with type 1 poliovirus.

The number of poliomyelitis cases reported in Kansas City during 1959 was 210; 118 were

paralytic and 92 were nonparalytic. Eleven of the paralytic cases were fatal. There were 146 cases among Negroes and 64 cases among whites, resulting in a racial incidence of 123.5 and 16.8 per 100,000, respectively.

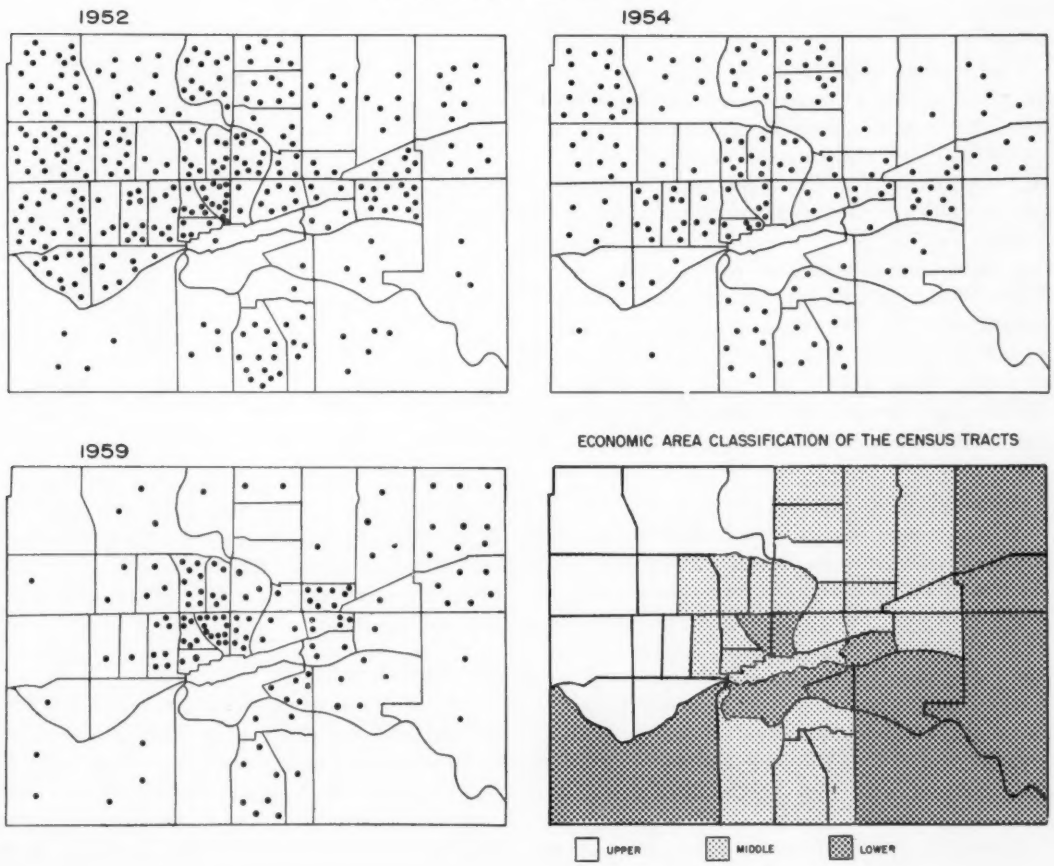
Virus studies were performed on the fecal specimens of 166 patients, 87 paralytic and 79 nonparalytic. Poliovirus type 1 was isolated from 76 percent of the paralytic cases and 67 percent of the nonparalytic cases. Other types of poliovirus were not detected. A nonpoliovirus, however, was recovered from eight patients, one with paralytic disease and seven with nonparalytic disease. The agents in two cases, both nonparalytic, were identified as Coxsackie B virus, one type 2 and the other type 5; the agents in the remaining six cases were unidentified.

Poliovirus CF tests were performed on paired serums from 24 patients who did not have virus in their feces and on 5 patients who submitted only paired serums. Fourfold or greater antibody response to poliovirus type 1 was detected in four patients, one having had a concomitant rise to poliovirus type 2.

Based on these results, 124 patients had proved enterovirus infections; type 1 poliovirus was the agent involved in 94 percent of these cases.

Although type 1 poliovirus was the principal causative agent of these two 1959 epidemics, Des Moines had a higher proportion of nonpoliomyelitis cases than Kansas City. Nearly 30 percent of the etiologically identified nonparalytic cases occurring in Des Moines did not have poliovirus infection, while only 12 percent of the

Figure 2. Distribution of reported poliomyelitis cases, by census tract, Des Moines, Iowa, epidemic years 1952, 1954, and 1959



virus-positive nonparalytic cases in Kansas City were associated with a nonpoliovirus.

Seasonal Pattern

The epidemic curves depicting the distribution of the 135 Des Moines cases and the 210 Kansas City cases by week of onset and paralytic status are illustrated in figure 1.

The Des Moines epidemic began in the latter part of May and ended in October. Three cases occurred in March. The epidemic had two distinct peaks, one during the week ending June 24 with 19 cases and the other during the week ending August 26 with 9 cases. In the first half of the epidemic, paralytic cases predominated over nonparalytic cases almost two to one. In the second half, the majority of cases were nonparalytic. All the etiologically proved nonpoliomyelitis cases occurred during the latter period. Therefore, the secondary peak was related to an increase of nonpoliovirus infections.

The Kansas City epidemic began in early June and ended in the middle of October. The number of cases increased rapidly and reached a peak of 27 cases during the week ending July 15. The paralytic cases predominated throughout the epidemic with no secondary rise of cases.

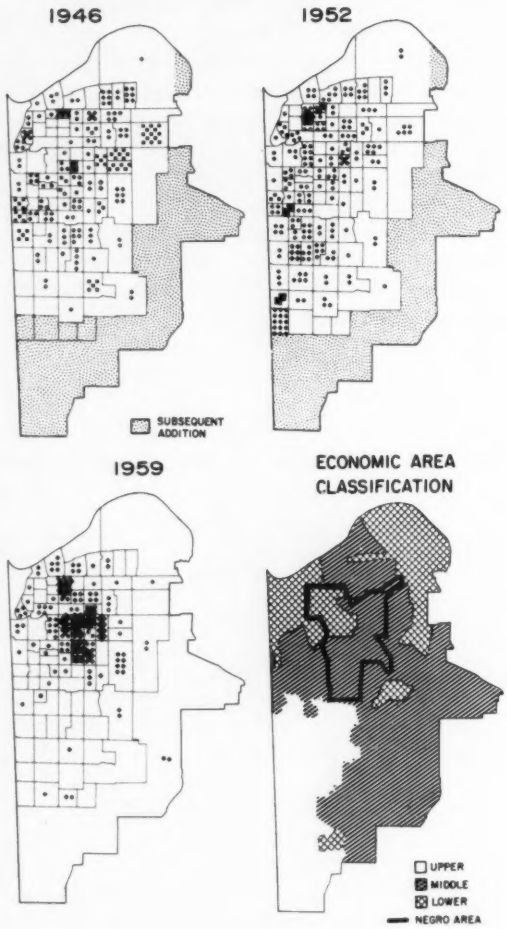
Both the Des Moines and Kansas City epidemics appeared unusually early in the year. When compared with the usual seasonal peak of poliomyelitis for the respective cities, the peak incidence of the 1959 Des Moines outbreak occurred about 2 months earlier and that of the Kansas City epidemic occurred 3 to 4 weeks earlier than usual.

Geographic Distribution

Figure 2 presents the distribution of the Des Moines cases by census tract. A definite concentration of cases occurred in the center of the city. The distribution pattern for the 1952 and 1954 epidemics is also shown. In these 2 years, the cases were widely distributed with no obvious concentration in any part of the city. This relationship is also evident when the geographic pattern of the 1959 Kansas City cases is compared with that of the 1946 and 1952 cases (fig. 3).

Since the lower socioeconomic segments of both the Des Moines and Kansas City populations are concentrated in the central census tracts, the localized geographic pattern observed in 1959 is a reflection of the frequent occurrence of poliomyelitis among the lower socioeconomic classes.

Figure 3. Distribution of reported poliomyelitis cases, by census tract, Kansas City, Mo., epidemic years 1946, 1952, and 1959



Socioeconomic Correlation

The attack rates of poliomyelitis in the Des Moines and Kansas City epidemics according to socioeconomic status are summarized in table 1. In 1959 the Negroes of both cities, who largely fall into the lower socioeconomic group, had the highest rate, and the incidence decreased

with increasing socioeconomic status. The Negro rate in Des Moines was 20 times higher than the white rate in the upper socioeconomic group; in Kansas City the corresponding rates showed a 32-fold difference. In contrast, the white rate in the upper socioeconomic group exceeded the Negro rate in the 1952 and 1954 Des Moines outbreaks as well as in the 1946 and the 1952 Kansas City outbreaks.

Age Distribution

In 1959 the highest incidence of poliomyelitis in both cities was in children under 5 years of age, with the children aged 5–9 years having the next highest rate (table 2). In Des Moines, the attack rate of preschool children was 1½ times greater than that of the group aged 5–9 years; in Kansas City, a threefold difference was observed between the rates of the two age groups. In Des Moines, the incidence among the children 10–14 years old was three times less than that of the group aged 15–19 years; this difference, however, was not noted in Kansas City. During the 1952 and 1954 epidemics in Des Moines, as well as during the 1946 and 1952 epidemics in Kansas City, the preschool children had lower rates than the children 5–9 years old.

Table 1. Poliomyelitis cases and rates,[1] by socioeconomic groups, in Des Moines, Iowa, 1952, 1954, and 1959, and in Kansas City, Mo., 1946, 1952, and 1959

Race and socioeconomic group	Des Moines						Kansas City					
	1952		1954		1959		1946		1952		1959	
	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate
White:												
Upper	134	224. 4	63	101. 4	10	15. 6	51	38. 0	105	78. 3	4	3. 8
Middle	128	143. 3	81	87. 6	50	51. 5	102	62. 1	64	39. 0	41	17. 5
Lower	50	159. 7	25	80. 6	42	132. 9	61	68. 9	64	72. 3	19	44. 7
Negro	3	30. 9	3	30. 3	33	320. 4	1	1. 8	19	33. 9	146	123. 5
All groups	315	165. 8	172	88. 0	135	66. 5	215	48. 6	252	56. 9	210	42. 0

[1] Number of cases per 100,000 population.

Table 2. Age-specific attack rates [1] of poliomyelitis in Des Moines, Iowa, 1952, 1954, and 1959, and in Kansas City, Mo., 1946, 1952, and 1959

Age group (years)	Des Moines						Kansas City					
	1952		1954		1959		1946		1952		1959	
	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate
0–4	73	396. 7	27	142. 8	54	271. 4	53	136. 6	77	198. 4	125	190. 2
5–9	82	525. 6	68	404. 8	38	189. 0	66	235. 7	60	214. 3	39	63. 5
10–14	39	304. 7	22	163. 0	6	37. 5	27	114. 9	25	106. 4	11	21. 0
15–19	30	254. 2	18	146. 3	16	112. 7	37	150. 4	22	89. 4	7	26. 0
20–39	80	131. 8	32	51. 5	16	26. 0	29	19. 9	67	45. 9	25	23. 3
40 and over	11	15. 6	5	7. 0	5	7. 0	3	1. 6	1	. 6	3	1. 6
All ages	315	165. 8	172	88. 0	135	66. 5	215	48. 6	252	56. 9	210	42. 0

[1] Number of cases per 100,000 population.

Table 3 summarizes the age-specific attack rates of the Des Moines residents by socioeconomic status for 1952, 1954, and 1959. In this table, a comparison is made of the rates between two major socioeconomic groups: the upper and middle white population versus the Negro and lower white population. In 1952 and 1954, the children in the upper and middle socioeconomic groups aged 5–9 years had the highest incidence of poliomyelitis; in the Negro and lower white socioeconomic group, the rates between the groups aged 0–4 and 5–9 years were not significantly different. In the 1959 epidemic, the preschool children of both socioeconomic groups had the highest rates. Also, in the 1952 and 1954 epidemics the rates among preschool children in the two major socioeconomic groups showed little difference. In contrast, during the 1959 epidemic the attack rate among preschool children in the lower white and Negro groups was more than five times that of preschool children in the upper and middle white groups. A similar relationship exists for Kansas City when the 1959 age pattern is compared with the age patterns of 1946 and 1952 (table 4).

Table 3. Poliomyelitis cases and rates,[1] by age and socioeconomic status, Des Moines, Iowa, 1952, 1954, and 1959

Age group (years)	1952				1954				1959			
	Upper and middle whites		Lower whites and Negroes		Upper and middle whites		Lower whites and Negroes		Upper and middle whites		Lower whites and Negroes	
	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate
0–4	54	388. 5	19	422. 2	17	118. 9	10	217. 4	20	131. 6	34	723. 4
5–9	63	538. 5	19	487. 2	60	468. 8	8	200. 0	15	100. 6	23	442. 3
10–14	36	375. 0	3	93. 8	19	186. 3	3	99. 9	2	16. 8	4	97. 6
15–19	26	288. 9	4	142. 8	14	147. 4	4	142. 9	11	100. 0	5	156. 2
20–39	75	155. 9	5	39. 7	29	58. 5	3	24. 0	9	18. 0	7	60. 3
40 and over	8	14. 1	3	21. 4	5	8. 6	0	0	3	5. 1	2	15. 3
All ages	262	175. 8	53	129. 3	144	93. 1	28	68. 4	60	37. 2	75	179. 0

[1] Number of cases per 100,000 population.

Table 4. Poliomyelitis cases and rates,[1] by age and socioeconomic status, Kansas City, Mo., 1946, 1952, and 1959

Age group (years)	1946				1952				1959			
	Upper and middle whites		Lower whites and Negroes		Upper and middle whites		Lower whites and Negroes		Upper and middle whites		Lower whites and Negroes	
	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate	Number cases	Rate
0–4	29	119. 3	24	165. 5	37	152. 3	40	275. 9	20	54. 2	105	364. 6
5–9	51	281. 8	15	151. 5	35	193. 4	15	151. 5	5	13. 8	34	134. 4
10–14	20	130. 7	7	85. 4	18	117. 6	7	85. 4	3	8. 7	8	44. 2
15–19	27	166. 7	10	119. 0	16	98. 8	6	71. 4	1	5. 9	6	60. 6
20–39	23	23. 7	6	12. 2	52	53. 6	15	30. 6	14	19. 5	11	31. 2
40 and over	3	2. 3	0	0	1	. 8	0	0	2	1. 4	1	2. 3
All ages	153	51. 3	62	42. 9	159	53. 3	83	57. 4	45	13. 3	165	102. 7

[1] Number of cases per 100,000 population.

Influence of Salk Vaccination

The data in table 5 correlate the paralytic attack rates of children under 15 years of age by socioeconomic and vaccination status. In both epidemics, the upper socioeconomic white population had the highest level of vaccination (three or more injections), and the level of vaccination decreased with descending socioeconomic status. The incidence of paralytic poliomyelitis was inversely related to the vaccination level. For example, the upper white group, who were best protected by the Salk vaccine, had the lowest incidence of paralytic disease; the Negroes and lower white groups, who had the smallest number of inoculations, had the highest incidence.

On the basis of these data, it appears that the Salk vaccine had a marked influence on the incidence of paralytic poliomyelitis in both the Des Moines and Kansas City epidemics. The estimated effectiveness of the vaccine in reducing the incidence of paralytic poliomyelitis in persons under 40 years of age was 80 percent for Des Moines and 77 percent for Kansas City. The methods used for calculating these estimates are shown in tables 6 and 7.

The incidence of paralytic poliomyelitis among unvaccinated children under 15 years of age in Des Moines and Kansas City is summarized in table 8 according to socioeconomic status. The paralytic attack rates among the unvaccinated children also varied inversely with their socioeconomic levels. In the upper white population of Des Moines, 1,600 children under 15 years of age were unvaccinated; not one case of paralytic poliomyelitis was reported in this group. On the other hand, 12 cases of paralytic poliomyelitis were observed in 1,700 unvaccinated Negroes under 15 years of age. In Kansas City, no paralytic cases occurred among 2,600 unvaccinated upper white children under 15 years of age, whereas 32 cases were observed among 10,800 unvaccinated Negroes of lower income families in this age category.

Discussion

In the past several years, epidemic poliomyelitis in the United States has manifested a different epidemiologic pattern from that usually observed. This alteration in pattern was first noted in the Chicago poliomyelitis epidemic of

Table 5. Incidence of paralytic poliomyelitis, by age, socioeconomic status, and vaccination status, Des Moines, Iowa, and Kansas City, Mo., 1959

Age, race, and socioeconomic group	Des Moines				Kansas City			
	Population		Cases		Population		Cases	
	Total	Percent with 3 or more inoculations	Number	Rate per 100,000 population	Total	Percent with 3 or more inoculations	Number	Rate per 100,000 population
0–4 years								
White:								
Upper	6,900	65	2	29.0	9,200	64	1	10.9
Middle	8,300	58	10	120.5	27,700	46	10	36.1
Lower	3,200	36	13	406.2	7,500	35	6	80.0
Negro	1,500	30	4	266.7				
Middle					11,900	30	23	193.3
Lower					9,400	11	32	340.4
5–14 years								
White:								
Upper	12,400	90	0	0	22,800	95	0	0
Middle	14,400	60	5	34.7	47,700	75	2	42.2
Lower	6,200	58	8	129.0	9,900	79	2	20.2
Negro	3,100	43	12	387.1				
Middle					19,200	60	7	36.4
Lower					14,300	43	9	62.9

1956 (*8*). A similar observation was reported in the 1957 epidemic in Washington, D.C. (*9*), and in the 1958 Detroit epidemic (*10*). In these, as well as in the 1959 epidemics in Des Moines and Kansas City, high rates prevailed among the preschool children. In Des Moines, 41 percent of the paralytic cases were in children under 5 years of age (*11*); in Kansas City, 61 percent were in children of this age category (*12*).

The Negroes were the most susceptible group in the population. The attack rate for the Negroes in Des Moines was 20 times higher than that for the upper whites, and in Kansas City, it was 32 times higher. Comparison of the rates for the lower and upper whites showed more than an eightfold difference in the Des Moines epidemic and a twelvefold difference in the Kansas City epidemic. The marked geographic localization of the cases reflects the frequent occurrence of poliomyelitis among the Negroes and lower whites living in the crowded areas in the center of the city (figs. 2 and 3).

The altered epidemiologic pattern observed was apparently related to the varying levels of vaccination in the population. In both Des Moines and Kansas City, the Negroes and lower whites had the highest attack rates, while the upper whites had the lowest. This difference in attack rates correlates well with the low vaccination status of the Negroes and lower whites and with the high vaccination status of the upper whites. Similarly, the shift in the age distribution of the 1959 cases can be attributed to the differential levels of vaccination among persons of various age groups. The preschool children had lower levels of vaccination than older children in all socioeconomic groups. This difference was particularly marked in Kansas City. In the previous epidemics (tables 3 and 4), the children in the upper and middle socioeconomic groups aged 5–9 years had the highest incidence of poliomyeli-

Table 6. Estimated effectiveness of vaccine [1] in reducing incidence of paralytic poliomyelitis in persons under 40 years of age, Des Moines, Iowa, 1959

Age, race, and socioeconomic group	Population, by number of vaccine doses		Paralytic cases, by number of vaccine doses		Paralytic cases per 100,000 in unvaccinated population	Expected cases in vaccinated population
	0 dose	3 or more doses	0 dose	3 or more doses		
0–4 years						
White:						
Upper	800	4, 400	0	2	0	0
Middle	2, 100	4, 800	7	0	333. 3	16. 00
Lower	1, 200	1, 200	8	2	666. 7	8. 00
Negro	600	400	2	1	333. 3	1. 33
5–14 years						
White:						
Upper	800	11, 100	0	0	0	0
Middle	2, 500	8, 600	2	2	80. 0	6. 88
Lower	1, 400	3, 600	3	3	214. 3	7. 71
Negro	1, 100	1, 300	10	0	909. 1	11. 82
15–39 years						
White:						
Upper	5, 300	12, 400	0	0	0	0
Middle	21, 300	10, 100	4	1	18. 8	1. 90
Lower	6, 800	3, 900	2	0	29. 4	1. 15
Negro	1, 700	500	4	0	235. 3	1. 18
Total	45, 600	62, 300	42	11	.....	55. 97

[1] Vaccine effectiveness $= \frac{\text{Expected cases} - \text{observed cases}}{\text{Expected cases}} = \frac{55.97 - 11}{55.97} = 0.803.$

Table 7. Estimated effectiveness of vaccine [1] in reducing incidence of paralytic poliomyelitis in persons under 40 years of age, Kansas City, Mo., 1959

Age, race, and socioeconomic group	Population, by number of vaccine doses		Paralytic cases, by number of vaccine doses		Paralytic cases per 100,000 in unvaccinated population	Expected cases in vaccinated population
	0 dose	3 or more doses	0 dose	3 or more doses		
0–4 years						
White:						
Upper	2, 100	5, 900	0	1	0	0
Middle	8, 300	12, 600	7	2	84. 3	10. 62
Lower	3, 400	2, 600	4	1	117. 6	3. 06
Negro:						
Middle	6, 000	3, 500	15	3	250. 0	8. 75
Lower	5, 900	1, 000	28	1	474. 6	4. 75
5–14 years						
White:						
Upper	500	21, 600	0	0	0	0
Middle	4, 700	35, 600	0	2	0	0
Lower	1, 100	7, 800	1	0	90. 9	7. 09
Negro:						
Middle	4, 400	11, 400	4	1	90. 9	10. 36
Lower	4, 900	6, 200	4	1	81. 6	5. 06
15–39 years						
White:						
Upper	9, 000	13, 800	0	1	0	0
Middle	28, 300	21, 400	9	1	31. 8	6. 80
Lower	6, 800	3, 600	1	0	14. 7	. 53
Negro:						
Middle	12, 300	3, 600	6	0	48. 8	1. 76
Lower	10, 100	2, 800	5	0	49. 5	1. 39
Total	107, 800	153, 400	84	14		60. 17

[1] Vaccine effectiveness $= \frac{\text{Expected cases} - \text{observed cases}}{\text{Expected cases}} = \frac{60.17 - 14}{60.17} = 0.767.$

tis, while the rates among the Negro and lower socioeconomic white children under 5 years either equaled or exceeded those of the group aged 5–9 years. Therefore, this relative shift of the 1959 age distribution toward preschool children is related principally to the marked reduction of poliomyelitis among school-age children of the upper and middle socioeconomic classes.

The data reported in this paper indicate that Salk vaccination was highly effective in reducing the incidence of paralytic poliomyelitis among individuals who had received three or more injections of vaccine. The levels of protection observed in these studies were comparable to those reported in the 1954 poliomyelitis vaccine field trial (*13*).

Of particular interest are the data concerning the incidence of paralytic poliomyelitis among unvaccinated persons of various socioeconomic groups. In both the Des Moines and Kansas City studies, the incidence of paralytic poliomyelitis occurring among children under 15 years of age was inversely related to their socioeconomic status. These data, summarized in table 8, seem to suggest that the extent of poliovirus infection was different in different areas of the community. If the poliovirus were widely disseminated in all areas, one would expect a higher incidence of poliomyelitis among the unvaccinated upper white population than was observed. This wide dissemination of poliovirus infection in previous epidemics is suggested by the similarity of poliomyelitis rates among preschool children in both major socioeconomic groups (tables 3 and 4). These observations imply that Salk vaccine might have had an indirect effect on reducing the incidence of infection in the highly vaccinated upper white population. Although

Table 8. Incidence of paralytic poliomyelitis in unvaccinated children under 15 years of age, by socioeconomic status, Des Moines, Iowa, and Kansas City, Mo.

Race and socioeconomic group	Des Moines			Kansas City		
	Unvaccinated population	Number of cases	Rate per 100,000	Unvaccinated population	Number of cases	Rate per 100,000
White:						
Upper	1, 600	0	0	2, 600	0	0
Middle	4, 600	9	195. 6	13, 000	7	53. 8
Lower	2, 600	11	423. 1	4, 500	5	111. 1
Negro	1, 700	12	705. 9			
Middle				10, 400	19	182. 7
Lower				10, 800	32	296. 3

other factors might also have been operative, it appears reasonable to speculate, as Salk did (*14*), that when the vaccination level of a given area is sufficiently high, the immunity induced in the community by the vaccine might have an influence on limiting the spread of poliovirus in that area. In the Des Moines study, an attempt was made to determine the distribution of poliovirus by serial sampling of raw sewage in various areas of the community. The results indicate that the frequency of isolation of poliovirus from sewage obtained from the upper socioeconomic areas was significantly lower than that from the lower socioeconomic areas. These data will be presented in detail elsewhere (*15*).

Summary

In 1959, major epidemics of type 1 poliomyelitis occurred in Des Moines, Iowa, and Kansas City, Mo. A total of 135 cases were reported in Des Moines, and 210 cases were reported in Kansas City. In both epidemics the majority of the cases occurred among Negroes and the poorer white residents in the center of the city. The poliomyelitis attack rate among Negroes in Des Moines was 20 times that of the upper white population; in Kansas City, the difference was 32-fold. In both epidemics the incidence of poliomyelitis was highest in children under 5 years of age; this was at variance with the age distribution observed in previous epidemics in these two cities when the rates were generally highest in children 5–9 years old.

The epidemiologic pattern observed in the 1959 epidemic was different from that of previous epidemics. The change appears to be related largely to the widespread use of the Salk vaccine during recent years.

Both the Des Moines and the Kansas City data indicate that the Salk-type vaccine was highly effective in protecting adequately immunized individuals against paralytic poliomyelitis. The efficacy was estimated to be 80 percent in the Des Moines study and 77 percent in the Kansas City study. The data suggest that high levels of vaccination might also have an influence on limiting the spread of poliovirus in the community.

REFERENCES

(*1*) Wenner, H. A., and Miller, C. A.: Comparison of methods for recovering poliomyelitis virus from human sources. Proc. Soc. Exper. Biol. & Med. 86: 11–15, May 1954.

(*2*) Gravelle, C. R., Chin, T. D. Y., Adams, I. C., and Wenner, H. A.: Observations on infections with enterovirus in Missouri, 1956. Missouri Med. 56: 641–644, June 1959.

(*3*) Fulton, F., and Dumbell, K. R.: The serological comparison of strains of influenza virus. J. Gen. Microbiol. 3: 97–111, February 1949.

(*4*) Morgan, P., Carter, J. S., and Wenner, H. A.: An apparatus employed in plate complement-fixation tests. J. Lab. & Clin. Med. 42: 655–656, October 1953.

(*5*) Baumeister, J., and Miller, C. A.: The preparation of poliomyelitis complement-fixing antigens from infected tissue culture fluids. J. Infect. Dis. 98: 27–32, January–February 1956.

(*6*) Chin, T. D. Y., Beran, G. W., and Wenner, H. A.: An epidemic illness associated with a recently

recognized enteric virus (ECHO virus type 4). II. Recognition and identification of the etiologic agent. Am. J. Hyg. 66: 76–84, July 1957.

(7) Serfling, R. E., Cornell, R. G., Sherman, I. L., and Cohen, A.: Manual for conducting an immunization survey in an urban area. Atlanta, Ga., Communicable Disease Center, Public Health Service, 1960.

(8) Nathanson, N., et al.: Epidemic poliomyelitis during 1956 in Chicago and Cook County, Illinois. Am. J. Hyg. 70: 107–168, September 1959.

(9) Siedler, H. D., et al.: Outbreak of type 3 paralytic poliomyelitis in Washington, D.C., in 1957. Am. J. Hyg. 71: 29–44, January 1959.

(10) Molner, J. G., Brody, J. A., and Agate, G. H.: Detroit poliomyelitis epidemic, 1958. Preliminary report. J.A.M.A. 169: 1838–1842, Apr. 18, 1959.

(11) Chin, T. D. Y., et al.: Poliomyelitis in Des Moines, Iowa, 1959. The influence of Salk vaccination on the epidemic pattern and the spread of the virus in the community. Am. J. Hyg. (In press).

(12) Marine, W. M., Chin, T. D. Y., Gravelle, C. R., and Soergel, M.: Effectiveness of Salk vaccine in reducing nonparalytic poliomyelitis in a large urban epidemic. New England J. Med. 264: 903–907, May 4, 1961.

(13) Francis, T., Jr., et al.: Evaluation of the 1954 field trial of poliomyelitis vaccine (final report). Ann Arbor, Mich., University of Michigan, Poliomyelitis Vaccine Evaluation Center, 1957.

(14) Salk, J. E.: Preconceptions about vaccination against paralytic poliomyelitis. Ann. Int. Med. 50: 843–861 (1959).

(15) Wiley, J. S., Chin, T. D. Y., Gravelle, C. R., and Robinson, S.: Distribution of enteroviruses in sewage during a poliomyelitis epidemic. (Manuscript in preparation.)

Antibiotic Substance Found in Limburger

An antibiotic substance has been isolated from Limburger cheese by Nicholas Grecz, Ph.D., as part of his graduate work at the Illinois Institute of Technology. The work was performed by special arrangement at the Food Research Institute of the University of Chicago, under National Institutes of Health grant RG–5837 (C–1).

In the 1880's, in the early days of microbiology, there were numerous food poisoning outbreaks attributable to a Cheddar-type cheese. At that time it was observed that food poisoning outbreaks were never caused by Limburger-type cheese. Furthermore, it was known at that time that aged Limburger cheese did not become moldy.

Dr. Grecz, under the guidance of Dr. G. M. Dack, director of the Food Research Institute of the University of Chicago, and Dr. L. R. Hedrick, chairman of the biology department of the Illinois Institute of Technology, set out to determine what it was in Limburger cheese that protected it from food poisoning bacteria and from mold spoilage. Dr. Grecz was able to extract the active principle from Limburger cheese aged in the refrigerator for 8 weeks or longer. Extremely small amounts of the refined extracts prevented the growth of microorganisms which ordinarily cause food spoilage and food poisoning, as well as of some disease-producing germs.

The source of the antibiotic substance was traced to pigmented yellow-orange colonies of a bacterium which appears under the microscope as a minute, short rod. The scientific name of the bacterium is *Brevibacterium linens*. The germ becomes predominant on the surface of Limburger-type cheese at the late stages of the curing process. In addition to the production of the antibiotic substance, *B. linens* is thought to be responsible for the production of the brown surface smear on Limburger cheese. The antibiotic substance survives heating for almost 1 hour at pressure cooker temperature. When chemically refined, the substance is effective in extremely small amounts, which cannot be detected by taste. *B. linens* is also present on other surface ripened cheese, such as Brie, Liederkranz, Romadour, Tilsiter, Port du Salut, Muenster, Beer, Brick, Trappist, Harz, St. Mang, and others.

This antibiotic may have other potential uses in foods which to date have not been determined.

Education Notes

Hospital Administration. The University of California School of Public Health is offering a new program in hospital administration. Doctors of medicine, osteopathy, dentistry, and the paramedical disciplines and other candidates specially qualified by academic training or experience are offered a program leading to the master of public health degree. Students with a bachelor's degree are eligible for the degree of master of science in public health.

Academic courses include 18 units of hospital administration, medical care, and health administration plus 9 units in epidemiology, biostatistics, and environmental health. Minor deviations may be permitted, depending on the student. Certain students may concentrate in mental health administration, either in mental hospitals or community mental health agencies.

A 12-month administrative residency is required in the M.S. program, but in the M.P.H. program the residency may be reduced on the basis of experience, special studies, or planned periods of travel and observation. Residencies will be in the Los Angeles area, thus permitting continued contact between the faculty, preceptor, and resident.

Additional information may be obtained from Paul A. Lembcke, M.D., M.P.H., University of California, Los Angeles.

Occupational Health Nursing. A new master's degree program offered by the University of Washington School of Nursing is designed to prepare nurses for responsible positions in occupational health.

Open to nurses with a bachelor's degree, the program requires four academic quarters. Course content is flexible so that it will be of value to nurses with little or no occupational health experience as well as those with much experience. Additional work may be taken in business administration, sociology, public health, and related areas.

Enrollees are accepted at any time, but a better sequence of courses is available by beginning the summer or fall quarter. Candidates are eligible for Public Health Service professional nurse traineeships and nurse-education stipends from State health departments.

Applications and additional information are available from the School of Nursing, University of Washington, Seattle 5, Wash.

Cancer Fellowships. The International Union Against Cancer, through funds available from the Eleanor Roosevelt Cancer Foundation, will award annually fellowships for research.

These senior postdoctoral awards are designed to support full-time staff members of universities, teaching hospitals, research laboratories, or other institutions who have demonstrated interest and outstanding ability or potential as independent investigators in research on basic cancer or its experimental and clinical aspects, and who wish to study in another country.

The fellowships ordinarily will be awarded for 1 year, but this period may be extended or shortened in special circumstances. The stipend will be based on the applicant's current salary and the salary of persons of comparable qualifications in the place where he expects to study. Allowance will be made for dependents and travel.

Additional information may be obtained from the International Union Against Cancer, P.O. Box 400, Geneva 2, Switzerland.

Epidemiology. A 3-year residency, offered by the New York State Department of Health to a small number of physicians and holders of doctorates in related disciplines, will train the recipients as epidemiologists. Stress will be placed on coordinating clinical, laboratory, and field investigations and on research methods, particularly those applicable to diseases of noninfectious and unknown etiology.

During the first year fellows will work with practicing epidemiologists concerned with both applied and research problems. They will also have opportunity to observe other public health activities. Second-year fellows will be expected to attend one of the graduate schools of public health and to complete requirements for the master of public health degree. The last 16 months will be spent in substantially independent research.

Fellows will receive full support, tuition, and dependency allowances throughout the 3 years. Applicants with appropriate experience may enter the program at the second- or third-year level.

Additional information may be obtained from William Haddon, Jr., M.D., Director, Epidemiology Residency Program, New York State Department of Health, 84 Holland Avenue, Albany 8, N.Y.

Viricidal Efficiency of Disinfectants in Water

PAUL W. KABLER, M.D., Ph.D., NORMAN A. CLARKE, Ph.D., GERALD BERG, Ph.D., and SHIH L. CHANG, M.D.

RECALLING the recent outbreak of waterborne infectious hepatitis in New Delhi, India (*1*), and the discovery in the past decade of more than 70 new human enteric viruses, it seems appropriate to review the information available regarding the viricidal efficiency of disinfectants in water. The term "enteric viruses" as used here includes infectious hepatitis virus, Coxsackie groups A and B, poliovirus, adenovirus, and the ECHO viruses. All of these are excreted in feces and can be found in urban sewage, especially in the late summer and early fall. Proved waterborne epidemics have occurred only with the virus of infectious hepatitis; however, outbreaks of poliomyelitis suspected of being waterborne have been reported (*2,3*). No waterborne diseases caused by Coxsackie and ECHO viruses have been recorded. No adenovirus infections have been attributed to drinking water, but three outbreaks of one of the clinical diseases caused by adenoviruses have been associated with swimming pools (*4–6*).

Chlorine

Because chlorine reacts with organic matter and forms combined chlorine compounds, reliable data on virus destruction depend on the chemical definition of the test water and determination of the types of titrable chlorine present, which are markedly influenced by the pH of the substrate. The rate of kill under fixed test conditions is proportional to the concentration of the kind of chlorine available. Sufficient demand-free virus material should be present to allow for accurate determination of the inactivation rate. Since many of the earlier studies on the destruction of viruses by chlorine did not meet these criteria, the resulting data are not included in this review. The reports before 1946 did not differentiate between free and combined chlorine, and many of the reports also showed such a high chlorine demand of the test system that the data on the viricidal efficiency of chlorine cannot be accurately interpreted.

Free Chlorine

Information on the viricidal efficiency of free chlorine in water is presented in the table. The amounts of free chlorine recorded in this table for the studies of Theiler's virus (*7*), infectious hepatitis virus (*8*), and type 2 poliovirus (*9, 10*) refer to the initial concentration. In each test the residual chlorine values were reduced to less than 1 mg./l. In the other investigations, the residual chlorine was not substantially less than the initial content (*11–14*).

The data of Weidenkopf (*12*) on poliovirus type 1 are probably most accurate because the test conditions are well defined, and the plaque count technique provides an accurate estimation of virus concentration. Taking into consider-

All the authors are with the Microbiology Section, Water Supply and Pollution Control Research, Sanitary Engineering Center, Public Health Service, Cincinnati, Ohio. Dr. Kabler is chief of the section; Dr. Clarke is in charge of virus disease studies; Dr. Berg is a virologist, and Dr. Chang is in charge of water treatment evaluations. *This paper was presented at the 88th annual meeting of the American Public Health Association on November 1, 1960.*

ation differences in procedures of the several investigators, the information in the table reveals several significant points.

The data indicate that Theiler's virus is more resistant to the action of free chlorine than Coxsackie A2 virus, which is more resistant than poliovirus type 1. Adenovirus type 3 shows about the same resistance as does *Escherichia coli* (*14*). The comparative resistance of infectious hepatitis virus is not clearly shown because not enough contact times were tested. It is apparent, however, that the different viruses vary widely in their susceptibility to free chlorine. The pH exerts marked effects on the viricidal efficiency of free chlorine. Weidenkopf's tests (*12*) show that decreasing the pH from 7.0 to 6.0 reduces the required inactivation time by about 50 percent, and the findings of both Weidenkopf (*12*) and Clarke and others (*14*) indicate that a rise in pH from 7.0 to 8.8–9.0 increases the inactivation period about six times.

Viricidal efficiency of free chlorine in water

Virus [1]	Temperature (degrees centigrade)	Final pH	Free chlorine (mg./l.)	Virus destruction (percent/minutes)
Partially purified Theiler's virus in tapwater (Chang, et al., *7*).	25–27	6. 5–7. 0	4. 0–6. 0	98.6/10
	25–27	6. 5–7. 0	4. 0–6. 0	99/5
Feces-borne infectious hepatitis virus in distilled water (Neefe, et al., *8*).	Room	6. 7–6. 8	3. 25	[2]
Purified poliovirus 2 in distilled and lake water (Lensen, et al., *9*, *10*).	19–25	7. 4–7. 9	1. 0–1. 5	[3]
Purified Coxsackie A2 in demand-free water (Clarke and Kabler, *11*).	3–6	6. 9–7. 1	. 58–. 62	99.6/10
	3–6	6. 8–7. 1	1. 9–2. 2	99.6/4
	3–6	6. 9–7. 1	3. 8–4. 2	99.6/2½
	3–6	8. 8–9. 0	1. 9–2. 0	99.6/24
	3–6	8. 8–9. 0	3. 7–4. 3	99.6/9
	3–6	8. 8–9. 0	7. 4–8. 3	99.6/5
	27–29	6. 9–7. 1	. 16–. 18	99.6/4
	27–29	6. 9–7. 1	. 44–. 58	99.6/3
	27–29	8. 8–9. 0	. 10–. 18	99.6/10
	27–29	8. 8–9. 0	. 27–. 32	99.6/7
	27–29	8. 8–9. 0	. 92–1. 0	99.6/3
Purified poliovirus 1 (Mahoney) in demand-free water (Weidenkopf, *12*).	0	6. 0	. 39	99.6/3½
	0	6. 0	. 80	99.6/1½
	0	7. 0	. 23	99.6/8
	0	7. 0	. 53	99.6/4½
	0	8. 5	. 53	99.6/16
	0	8. 5	1. 95	99.6/7½
	0	8. 5	5. 00	99.6/3
Purified poliovirus 1 (Mahoney) in demand-free water (Kelly and Sanderson, *13*).	25–28	7. 0	. 21–. 30	99.9/3
	25–28	9. 0	. 21–. 30	99.9/8
Purified poliovirus 3 (Saukett) in demand-free water (Kelly and Sanderson, *13*).	25–28	7. 0	. 11–. 20	99.9/2
	25–28	9. 0	. 11–. 20	99.9/16
Purified Coxsackie B5 in demand-free water (Kelly and Sanderson, *13*).	25–28	7. 0	. 21–. 30	99.9/1
	25–28	9. 0	. 21–. 30	99.9/8
	1–5	7. 0	. 21–. 30	99.9/16
	1–5	8. 0	. 21–. 30	99.9/30
Purified adenovirus 3 in demand-free water (Clarke, et al., *14*).	25	8. 8–9. 0	. 20	99.8/40–50 sec.
	25	6. 9–7. 1	. 20	99.8/8–16 sec.
	4	8. 8–9. 0	. 20	99.8/80–100 sec.
	4	6. 9–7. 1	. 20	99.8/8–10 sec.

[1] Figures in parentheses are reference numbers.
[2] 30 minutes contact time protected all of 12 volunteers.
[3] 10 minutes contact time protected all of 164 inoculated mice.

In the destruction of viruses by chlorine, Clarke's work (*14*) suggests that the temperature coefficient for a 10° change (Q_{10}) is in the range of 2 to 3, indicating that the inactivation time must be increased 2 to 3 times when the temperature is lowered 10°C. Data in the table also indicate that the chlorine concentration coefficient (N) lies in the range of 0.7 to 0.9. This means that the inactivation time is reduced a little less than half when the free chlorine concentration is doubled. To increase virus kill, therefore, there is some advantage in increasing the contact time instead of raising the chlorine content.

Kelly and Sanderson (*13*) also observed that the viricidal efficiency of free chlorine is dependent on pH, temperature, chlorine concentration, and exposure time. In addition, they pointed out that complete inactivation of some enteric viruses cannot be attained by exposure to 0.2 mg./l. of chlorine for 10 min. at pH 7.0 (usual bacterial parameters of disinfection) at an initial level of 300 to 3,000 virus doses per milliliter in the water.

With low chlorine residuals, the virus inactivation rate is markedly affected by temperature and pH. Studies indicate that at a temperature of approximately 20° C. and pH values no higher than 8.0–8.5, a free chlorine residual of 0.2 to 0.3 mg./l. will probably destroy most of the tested viruses in 30 minutes. At temperatures below 10–15° C. and pH values greater than 8.5, effective virus kills with free chlorine residuals of 0.2 to 0.3 mg./l. are probably not attainable without long detention periods.

Combined Chlorine

Trask and others (*15*) found that 5.4 mg./l. of residual chlorine as chlorine-ammonia was required to destroy 90 percent of Theiler's virus (FA strain) in 30 minutes, and 8.1 mg./l. was required for the same destruction in 10 minutes, when the weight ratio of chlorine to ammonia was 1 to 4. The temperature and pH of the treated water were not stated. At 26° C., a pH of 6.8 to 7.1, and a chlorine-ammonia weight ratio of 2 to 3, Chang and co-workers (*7*) observed that 5.2 mg./l. of residual chlorine killed only 85.7 percent of Theiler's virus in 60 minutes. Trask and associates (*15*) also stated that 12.1 mg./l. of titrable chlorine as azochloramid destroyed 90 percent of Theiler's virus in 30 minutes, and Fair and associates (*16*) found that 18 to 20 mg./l. of titrable chlorine as monochloramine T killed 60 to 80 percent of Theiler's virus in 60 minutes at 27° C. and pH of 7.0 to 7.2. These data clearly show the low viricidal efficiency of these compounds.

Kelly and Sanderson (*17*) showed that poliovirus (type 1, MF 500 and Mahoney strains) and Coxsackie virus (group B, type 5, EA 80) in water were inactivated by combined residual chlorine, the effective concentration depending on pH, contact time, and strain of virus. In general, longer contact was required to destroy type 1 poliovirus than Coxsackie B virus in this study, and increasing the pH decreased the rate of inactivation. At 25° C. and a pH of 7, a concentration of at least 9 mg./l. was necessary for inactivation of poliovirus with a contact period of 30 minutes, and of 6 mg./l. with a 1-hour contact period. A concentration of 0.5 mg./l. required a contact period of more than 7 hours. These data indicate that present methods of disinfecting water with combined chlorine may not be adequate to destroy the more resistant virus strains.

Chlorine Dioxide

Ridenour and Ingols (*18*) found chlorine dioxide to be as effective as free chlorine in inactivating poliovirus if the residuals are measured by the orthotolidine-arsenite (OTA) method. In 1953, Hettche and Schulz-Ehlbeck (*19*) reported that 0.08 mg./l. chlorine dioxide, measured by the orthotolidine (OT) method, showed the same viricidal activity for poliovirus as 0.15 mg./l. ozone or 0.25 mg./l. free chlorine. However, Post and Moore (*20*) report that the OT and OTA methods make no distinction between chlorine and chlorine dioxide. Critical comparison of data on the viricidal efficiency of free chlorine and chlorine dioxide is therefore impossible if OT or OTA methods are used to measure the chlorine dioxide content.

Iodine

Recent reports (*21*, *22*) indicate that different enteric viruses may exhibit varying resist-

ances to iodine and that Coxsackie A2 and B1 viruses have about the same resistance to molecular iodine, but that these two viruses have twice the resistance of poliovirus type 1 or ECHO 7 virus.

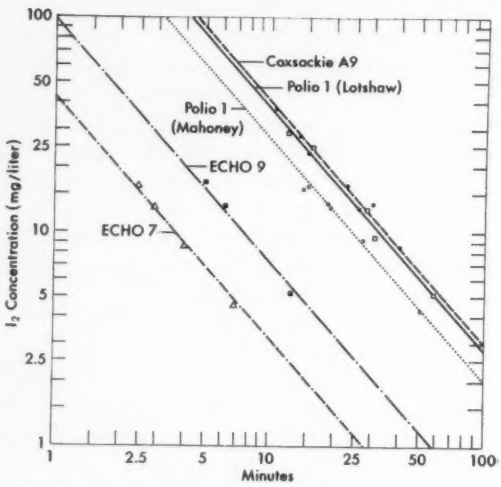
Berg and associates (*23*) studied the destruction of several enteric viruses by elemental iodine (I_2) under carefully controlled conditions. The chart shows the relationship of contact time and I_2 concentration required for 99 percent destruction of each of five viruses tested at 15° C. The slopes of all the lines are about the same and indicate that a change in contact time will have a slightly greater effect than a proportional change in the iodine concentration. Coxsackie A9 virus was the most resistant virus tested, requiring 10 mg./l. of I_2 to destroy 99 percent of the agent in 34 minutes at 15° C. At the same temperature and I_2 concentration, 99 percent of ECHO 7 virus was killed in 3½ minutes. Poliovirus type 1, Lotshaw strain, was almost as resistant as Coxsackie A9 virus, while the resistance of poliovirus type 1, Mahoney strain, and ECHO 9 virus fell between the two extremes. With essential conditions constant, about 10 times longer contact time was required to destroy the most resistant virus as was needed to destroy the least resistant virus tested. In other comparative tests, at 25° C., 99 percent of Coxsackie A9 virus was destroyed in 52 minutes by 1.0 mg./l. of I_2, while the same concentration of I_2 (extrapolated data) destroyed 99 percent of *E. coli* in only 0.03 minute. Thus the contact time for the Coxsackie virus was more than 1,700 times that for the *E. coli*.

Iodide and iodate ions are completely inert as viricides. Tri-iodide is either inert or acts so slowly that it is ineffective under most test conditions. Hypoiodous acid, which increases in concentration as the pH of the water increases, appears to be a more potent viricide than I_2.

Ozone

Kessel and co-workers (*24*) reported that 0.05 to 0.45 mg./l. of ozone destroyed the same quantity of poliovirus in 2 minutes as did 0.5 to 1.0 mg./l. of residual gaseous chlorine in 1½ to 3 hours. Because a crude-virus suspension was used in the test and the types of residuals were not differentiated, it seems likely that most of the residual chlorine was in the combined form. The findings of Hettche and Schulz-Ehlbeck (*19*) also indicated that, on a weight basis, ozone was somewhat more viricidal for poliovirus than was free chlorine.

Relationship of contact time and concentration of iodine (I_2) at 15° C. required for 99 percent destruction of five viruses



Ultraviolet Light

The studies of Habel and Sockrider (*25*), Murray and co-workers (*26*), Milzer and co-workers (*27*), and Oppenheimer and co-workers (*28*), have shown that many viruses and vaccines including enteroviruses in liquid suspensions can be inactivated by ultraviolet irradiation. Carlson and associates (*29*) found that ultraviolet irradiation was more effective in destroying poliovirus in water than coagulation and sedimentation, filtration, activated charcoal, or storage, although their results cannot be considered a quantitative measure of the effectiveness of these methods. Coxsackie A virus and Theiler's virus in water were more resistant than *E. coli* to ultraviolet light in studies by Gilcreas and Kelly (*30*). One major difficulty in ultraviolet light sterilization of water is the lack of a rapid field test to determine whether the water has been ade-

quately treated. It is therefore necessary that the treatment unit be equipped with an internally situated ultraviolet energy source that supplies a stable energy application and that this incident energy penetrate the fluid and provide an essentially uniform density throughout the fluid as it passes through the effective radiation area.

Summary

Data from recent studies of the efficiency of various disinfectants in inactivating enteric viruses in water appear to support the following summarizations:

1. Different types of enteric viruses vary widely in the degree of resistance to free chlorine. Poliovirus, Coxsackie, and some ECHO viruses seem to be more resistant than coliform or enteric pathogenic bacteria. The free chlorine residuals required for inactivation depend on pH, temperature, and contact time.

2. Combined chlorine is considerably less viricidal than free chlorine, requiring higher concentrations or longer contact periods to achieve comparable inactivation.

3. Iodine is an effective viricide, but requires greater residuals and longer contact than hypochlorous acid.

4. Chlorine dioxide, ozone, and ultraviolet light may be useful disinfectants; however, their efficiency in water in comparison with that of free chlorine and the quantitative effects of pH and temperature have not been established.

REFERENCES

(1) Visiwanathan, R., et al.: Infectious hepatitis in Delhi (1955–56); a critical study. Indian J. M. Res. 45, January 1957, supp.

(2) Bancroft, P. M., Engelhard, W. E., and Evans, C. A.: Poliomyelitis in Huskerville (Lincoln), Nebraska. J.A.M.A. 164: 836–847, June 22, 1957.

(3) Little, G. M.: Poliomyelitis and water supply. Canad. J. Pub. Health 45: 100–102, March 1954.

(4) Cockburn, T. A.: The epidemics of infectious keratoconjunctivitis associated with a pharyngitis and systemic symptoms in Missouri and Colorado. To be published.

(5) Bell, J. A., et al.: Pharyngoconjunctival fever; epidemiological studies of a recently recognized disease entity. J.A.M.A. 157: 1083–1092, Mar. 26, 1955.

(6) Ormsby, H. L.: An interim report on ocular diseases due to APC viruses in Ontario. Canad. J. Pub. Health 46: 500–505, December 1955.

(7) Chang, S. L., et al.: Annual report on germicides to the Quartermaster General, U.S. Army, 1946–47.

(8) Neefe, J. R., Baty, J. B., Reinhold, J. G., and Stokes, J., Jr.: Inactivation of the virus of infectious hepatitis in drinking water. Am. J. Pub. Health 37: 365–372, April 1947.

(9) Lensen, S. G., Rhian, M., and Stebbins, M. R.: The inactivation of partially purified poliomyelitis virus in water by chlorination. J. Am. Water Works A. 38: 1069–1077, September 1946.

(10) Lensen, S. G., Rhian, M., and Stebbins, M. R.: The inactivation of partially purified poliomyelitis virus in water by chlorination. II. Am. J. Pub. Health 37: 869–874, July 1947.

(11) Clarke, N. A., and Kabler, P. W.: The inactivation of purified Coxsackie virus in water by chlorine. Am. J. Hyg. 59: 119–127, January 1954.

(12) Weidenkopf, S. J.: Inactivation of type 1 poliomyelitis virus with chlorine. Virology 5: 56–67, February 1958.

(13) Kelly, S., and Sanderson, W. W.: The effect of chlorine in water on enteric viruses. Am. J. Pub. Health 48: 1323–1334, October 1958.

(14) Clarke, N. A., Stevenson, R. E., and Kabler, P. W.: The inactivation of purified type 3 adenovirus in water by chlorine. Am. J. Hyg. 64: 314–319, November 1956.

(15) Trask, J. D., Melnick, J. L., and Wenner, H. A.: Chlorination of human, monkey-adapted, and mouse strains of poliomyelitis virus. Am. J. Hyg. 41: 30–40, January 1945.

(16) Fair, G. M., Chang, S. L., and Moore, E. W.: Annual summary report on germicides to the Quartermaster General, U.S. Army, 1948.

(17) Kelly, S. M., and Sanderson, W. W.: The effect of chlorine in water on enteric viruses. II. The effect of combined chlorine on poliomyelitis and Coxsackie viruses. Am. J. Pub. Health 50: 14–20, January 1960.

(18) Ridenour, G. M., and Ingols, R. S.: Inactivation of poliomyelitis virus by "free" chlorine. Am. J. Pub. Health 36: 639–644, June 1946.

(19) Hettche, H. O., and Schulz-Ehlbeck, H. W.: Epidemiology and prophylaxis of poliomyelitis with respect to the role of water in its transmission. Arch. Hyg. u. Bact. 137: 440–449, June 1953.

(20) Post, M. A., and Moore, W. A.: The determination of chlorine dioxide in treated surface waters. Analyt. Chem. 31: 1872–1874, November 1959.

(21) Chang, S. L.: The use of active iodine as a water disinfectant. J. Am. Pharm. A. 47: 417–423, June 1958.

(22) Chang, S. L., and Berg, G.: Chlormelamine and iodized chlormelamine germicidal rinse formulations; essential physical and chemical characteristics and germicidal efficiencies. U.S. Armed Forces M. J. 10: 33–49, January 1959.

(23) Berg, G., Chang, S. L., and Kabler, P. W.: Dynamics in the destruction of enteroviruses by elemental iodine. Presented at the annual meeting, Society of American Bacteriologists, Philadelphia, 1960.

(24) Kessel, J. F., Allison, D. K., Moore, F. J., and Kaine, M.: Comparison of chlorine and ozone as viricidal agents of poliomyelitis virus. Proc. Soc. Exper. Biol. & Med. 53: 71–73, May 1943.

(25) Habel, K, and Sockrider, B. T.: A continuous flow method of exposing antigens to UV radiation. J. Immunol. 56: 273–279, July 1947.

(26) Murray, R., et al.: Effect of ultraviolet radiation on the infectivity of icterogenic plasma. J.A.M.A. 157: 8–14, Jan. 1, 1955.

(27) Milzer, A., et al.: Immunogenicity studies in human subjects of trivalent tissue culture poliomyelitis vaccine inactivated by ultraviolet irradiation. Am. J. Pub. Health 44: 26–33, January 1954.

(28) Oppenheimer, F., Benesi, E., and Taylor, A. R.: The ultraviolet irradiation of biological fluids in thin-flowing films. Am. J. Pub. Health 49: 903–923, July 1959.

(29) Carlson, H. J., Ridenour, G. M., and McKhann, C. F.: Efficacy of standard purification methods in removing poliomyelitis virus from water. Am. J. Pub. Health 32: 1256–1262, November 1942.

(30) Gilcreas, F. W., and Kelly, S. M.: Significance of the coliform test in relation to intestinal virus pollution in water. J. New England Water Works A. 68: 255–277, September 1954.

PUBLICATION ANNOUNCEMENTS

Address inquiries to the publisher or sponsoring agency.

Home Care. Hospital Monograph Series No. 9. By David Littauer, M.D., I. Perome Flance, M.D., and Albert F. Wessen, Ph.D. 1961; 110 pages; $2.75. American Hospital Association, 840 North Lake Shore Drive, Chicago 11.

Planning for Better Hospital Care. Report on the hospitals and health agencies of the Federation of Jewish Philanthropies in New York. By Eli Ginzberg and Peter Rogatz, M.D. 1961; 131 pages; $5. King's Crown Press, 2960 Broadway, New York 27.

Chronic Disease and Rehabilitation. A program guide for State and local health agencies. By the Program Area Committee on Chronic Disease and Rehabilitation, American Public Health Association. 1960; 116 pages. American Public Health Association, Inc., 1790 Broadway, New York 19.

Guide to the Preparation and Use of Projection Slides. 1961; 28 pages; $1.25. American Petroleum Geologists, Box 979, Tulsa 1, Okla.

A Look Ahead in Public Health. Proceedings of the 26th Annual New England Health Institute. 46 pages; 1960; Vermont Department of Health, Public Health Education, 115 Colchester Ave., Burlington, Vt.

Family Spending Patterns and Health Care. By H. Ashley Weeks. 1961; 140 pages; $3.50. Harvard University Press, Cambridge, Mass.

Health Careers Exchange. No. 1, March 1961; 4 pages. Health Careers Program, National Health Council, 1790 Broadway New York 19.

World Health Organization

WHO publications may be obtained from the Columbia University Press, International Documents Service, 2960 Broadway, New York 27, N.Y.

Expert Committee on Health Statistics. Seventh report. Technical Report Series No. 218. 1961; 28 pages; 30 cents; Geneva.

International Work in Health Statistics, 1948–1958. By H. S. Gear, M.D., Y. Biraud, M.D., and S. Swaroop, Ph.D. 1961; 56 pages; 60 cents; Geneva.

Expert Committee on Malaria. Eighth report. WHO Technical Report Series No. 205. 1961; 60 cents; Geneva.

The Undergraduate Teaching of Psychiatry and Mental Health Promotion. Ninth report of the Expert Committee on Mental Health. WHO Technical Report Series No. 208. 1961; 30 cents; Geneva.

Expert Committee on Addiction-Producing Drugs. Eleventh report. WHO Technical Report Series No. 211. 1961; 30 cents; Geneva.

Aspects of Public Health Nursing. WHO Public Health Papers 4. 1961; $1.75; Geneva.

Trends in Juvenile Delinquency. By T. C. N. Gibbens. WHO Public Health Papers 5. 1961; 60 cents; Geneva.

Specifications for Pesticides. Second edition. 1961; $10; Geneva.

The Work of WHO, 1960. Official Records of the World Health Organization, No. 105. Annual Report of the Director-General to the World Health Assembly and to the United Nations. 1961; $2; Geneva.

Radiation Control in Public Health

RUSSELL H. MORGAN, M.D.

PUBLIC HEALTH PROGRAMS in the field of radiation control in the United States have grown rapidly in recent years, and their growth is expected to continue.

The first record of a budgetary appropriation in the field of radiological health in the Public Health Service was in fiscal year 1948. The amount set aside was $17,000. By 1952, appropriations had grown to an annual level of approximately $350,000, a twentyfold increase in a period of 4 years. During the next 6 years, growth was slow, as previous gains were digested. Then in 1958, radiological health activity burst forward again with the creation in the Public Health Service of a full Division of Radiological Health headed by Dr. Francis J. Weber. At about the same time there was established within the Office of the Surgeon General the National Advisory Committee on Radiation, a group of scientists from many disciplines, to consult with and advise the Surgeon General on questions of policy related to the control of radiation hazards.

With these developments, the budgetary growth of radiological health was again resumed. In fiscal year 1960, expenditures exceeded $2,500,000 and in the present fiscal year, 1961, outlays will rise above $6,700,000. Furthermore, if program development proceeds in the next few years according to the blueprint established by the National Advisory Committee on Radiation in 1959, the level of activity will approach the $50 million mark in 3 more years.

The radiological health program which is developing in the United States is rather unique in public health annals. Historically, major public health programs have developed after it has been amply demonstrated that a health problem involving substantial mortality and morbidity exists. In the radiation field, however, the total number of deaths which may be directly attributed to excessive exposure to ionizing radiation in the United States has been less than the number of persons killed on our highways in a single weekend. Also, a check of our hospitals reveals few persons whose presence is related to morbidity resulting from known radiation injury. Indeed, the overt evidence of a radiation health problem in the world today is so small that one may be justified in asking why it is receiving so much attention.

There are a number of answers to this question. One of the most important is worldwide awareness of the incredible devastation to human values which results when nuclear systems of even modest proportions, deliberately or accidentally, go out of control. The bombings of Nagasaki and Hiroshima have left an indelible mark on the minds of all people. The potential dangers to life and health which are inherent in the large peacetime programs in nuclear engineering, currently under development in this country and abroad, are well known. The intense activity in radiological health, therefore, is quite justified.

It is interesting, however, that this activity represents more a concern for the future than a concern for the present. This is not to say, of course, that all the problems in the field of radiological health lie in the future. Most of

Dr. Morgan is radiologist in chief at Johns Hopkins Hospital, Baltimore, Md. *This paper was presented as the Fourth Annual Lecture on Preventive Medicine at the Seventh Annual Meeting of the American College of Preventive Medicine, which was held in San Francisco in November 1960.*

us are aware that substantial radiation hazards exist today. However, the burgeoning programs now underway find justification in the scope of the enormous nuclear developments which will take place in the years ahead. It is expected that by the middle of the 1970's nuclear power will be competitive with power produced from fossil sources. When this time comes, the public health problems in our industrial complex and in our environment are likely to become substantial unless sound measures of preventive medicine are applied today.

In speaking of the nuclear industry, I speak not only of reactors, and their associated problems (that is, the processing of fuel elements, the mining of radioactive materials, reactor operation, and the disposition of reactor wastes) but also of the uses of their byproducts in medicine, industry, and other areas of human activity. These byproducts, being radioactive, pose a whole set of new control problems for the public health officer whether he be engineer or physician.

The basic program for dealing with radiation in defense of public health will be concerned with (*a*) the exposure of the population to ionizing radiation, (*b*) prevention of such exposure where possible, (*c*) minimization where exposure, either deliberate or accidental, is inevitable, and (*d*) care of the injured and restoration to safety of a seriously contaminated environment which presents a public threat. Those responsible for such a program will need to have comprehensive knowledge of the sources of radiation affecting the population, the degree of risk to public health from any one of these sources, the biomedical effects of exposure to ionizing radiation, the methods of caring for an exposed population, and the management of radioactive contaminants of the atmosphere, water, soil, and food, according to the nature of the contaminants and the form in which they appear.

Sources of Radiation

The sources of ionizing radiation which are of public health concern are manifold and in general may be divided into two categories: one, those sources which generally may expose the individual externally and, two, those sources which when inhaled, ingested, or received through the skin surface irradiate the body from within.

The external sources of greatest importance today are (*a*) the X-ray machine and other particle accelerators of medicine and industry, (*b*) critical assemblies, (*c*) useful reactor products either in the form of sealed radioisotope sources (for example, cobalt 60 teletherapy sources), reprocessed fuel elements, or unsealed radioisotope products for use in medicine, industry, and other fields of science, (*d*) reactor wastes, and (*e*) a number of naturally occurring radioactive materials. All of these sources, with the exception of the X-ray machine, may cause external exposure either by irradiation of the individual from a distance or by surface contamination.

The term "critical assembly" as used here refers to any system which contains fissionable material and which becomes critical when the number of neutrons produced in the system equals or exceeds those lost by capture or leakage. Under these conditions, a self-sustained chain reaction occurs with the production of relatively large amounts of fast neutrons and gamma radiation. Nuclear reactors constitute the typical critical assembly. However, a critical assembly may develop during the manufacture or reprocessing of the fuel elements of a reactor and under other experimental conditions where fissionable material may unexpectedly become concentrated.

Of the several external sources, the greatest contribution of radiation to the population of the United States has been the medical X-ray machine. The greatest cause for concern as to acute doses of radiation to small numbers of individuals, on the other hand, is the critical assembly and its fission products.

The internal sources of radiation include all of the radioactive elements, manmade or natural. By inhalation, ingestion, or absorption through abraded skin, these materials may lodge in the tissues and subject the cells to radiation at intimate range, delivering a concentrated sustained dose to a small region.

Biomedical Effects

The biomedical effects of human exposure to ionizing radiation fall into two broad categories: (*a*) the effects of repeated exposures to

relatively small doses of radiation and (*b*) the effects of exposure to single large doses. For convenience, the small-dose effects may be further classified into two major subdivisions: genetic effects and somatic effects.

Small-Dose Effects

Genetic effects, caused by irradiation of the reproductive organs, are marked by appearance of mutations in succeeding generations. Their significance is that an inapparent injury to the present generation may be conveyed to many generations to come. Furthermore, the genetic changes induced by a given dose of radiation appear to be irreversible; that is, they do not correct themselves. Hence, the genetic effects of small doses of radiation delivered over a period of time are cumulative. Also, the changes in the genes appear to be proportional to the dose, becoming more severe as the dose increases.

The somatic effects of small doses of radiation are produced by the irradiation of certain critical organs and may lead to the development, after the elapse of a variable amount of time, to a number of neoplastic states including leukemia (blood-forming organs), skin cancer, and bone cancer. In general, the somatic effects may be expected to be greater when the dose of radiation is high than when it is small. However, it is not at all certain that the magnitude of somatic damage is entirely proportional to radiation dose. It is quite possible that at extremely small doses, little or no somatic damage may be created; that is, there may be a threshold dose below which no somatic effect may be expected. However, the scientific data on this point are so uncertain that one must assume the existence of no somatic threshold dose until conclusive evidence to the contrary is forthcoming.

In addition to the specific effects of ionizing radiation on critical organs, radiation exposure may produce a more generalized effect on the individual such as early aging and premature death. The basis of this phenomenon is not understood. When death comes, it is usually due to a cause quite unrelated to identifiable exposure to radiation.

The quantitative relationships between low doses of radiation and their biomedical effects are not established with satisfactory precision. Indeed, almost every value which has been suggested for a particular dose-effect relationship has been challenged. However, as a guide, it may be worthwhile to cite at this time a few data to give some impression of the magnitude of the damage which may be produced by various levels of population exposure. It must be emphasized that these data are not based upon well-controlled comprehensive experimental investigation. Indeed, the future may prove some of these data to be incorrect by factors in excess of ten.

In regard to genetic effects, it has been estimated that an exposure dose of 30 roentgens to the gonads of an individual prior to reproduction is required to double the probability that a mutation will occur in the individual's children. Since the spontaneous mutation rate of the population is of the order of 2 percent, an exposure dose of 30 roentgens to the prereproductive segment of the population may be expected to increase the mutation rate to 4 percent.

It has been estimated that the probability of developing leukemia after a radiation exposure is 1 to 2 parts per million per roentgen of whole-body exposure dose for each year of survival after the exposure takes place. The probabilities for the development of most other neoplastic states appear to be smaller although this is not at all certain. In the phenomenon of life-shortening by radiation exposure, the data are particularly weak. Quantitative estimates of this dose-effect relationship vary through a wide range. One of the more widely quoted values is a life-shortening of 1 week per roentgen of whole-body exposure dose.

The foregoing data indicate that the genetic hazards of ionizing radiation are the most important for persons who have not completed the formation of their families. Current estimates of the exposure dose received by the reproductive organs of the population in the United States indicate that the contribution from medical X-ray sources is of the order of 5 roentgens prior to and during the family formation period of an average individual. This dose may be expected to increase the mutation rate of the population by 16 percent of the spontaneous level.

Large-Dose Effects

In the discussion of the effects of small repeated doses of radiation, it was noted that a considerable period of time usually elapses following an exposure before changes of any kind appear; that is, there are no immediate clinical manifestations of disease. When the whole-body dose exceeds 100 rads, however, clinical changes are likely to appear within a few hours to a few days. Indeed, a characteristic syndrome is produced whose severity is a function of the dose received and the sensitivity of the irradiated individual. This syndrome, often called the acute radiation syndrome, should be fully understood and easily recognized by anyone working in the field of radiological health. When serious radiation accidents occur, those people who have had the misforture to be exposed will manifest this syndrome and the success of one's treatment often depends upon its early recognition.

One of the most important problems which a physician faces when called upon to care for persons who have received acute large doses of radiation is the evaluation of the magnitude of the biomedical problems at the accident site. Reliable data on the exposure fields which prevailed during the accident are often absent or incomplete. No simple laboratory examination is available with which the exposed individual may be examined for a precise determination of the radiation exposure he has received. Instead, much rests upon the clinical skill of the physician to judge the seriousness of the situation from early clinical signs. Such judgments often are made difficult by an air of panic which frequently develops when radiation accidents have occurred. Not only do those who have been irradiated exhibit lapses in normal behavior, but unfortunately many of those who come to assist do so as well. It is the responsibility of the physician to restore order, to make a calm appraisal of the extent of the accidental exposure, and to proceed with clinical care of irradiated individuals.

It is difficult to overemphasize the value of a well-trained physician in a situation where there has been acute exposure to radiation. Here is an opportunity for public health action at its best. The clinical observations of the public health physician have substantial value in assessing the total condition. By working closely with the engineer, the physician is often the first to determine how serious a particular accident may be. If careful evaluation indicates that the damage is not great, the physician may do much to eliminate unnecessary apprehension. On the other hand, if the exposures have been high, a good physician will be able to move with confidence to take care of the injured and to give assurance to both the injured and their associates that the situation is well in hand.

The procedures to be carried out by the public health physician when a radiation accident occurs are relatively simple and are based principally on common sense. These procedures include: (*a*) evacuation of all exposed individuals to a nearby uncontaminated area where the injured may be isolated from one another and given first aid carefully, (*b*) survey of exposed persons for surface contamination by radioactive materials, (*c*) simple decontamination of body surfaces, (*d*) estimation of the radiation dose received, (*e*) saving of clothes, urine, feces, vomitus, and blood samples of the irradiated individuals for dosimetric study, (*f*) taking of a careful history of the accident, and (*g*) confining of the irradiated people to hospitals with careful evaluation and clinical study where the whole-body dose is suspected to be in excess of 100 rads.

Those who exhibit the acute radiation syndrome may be conveniently divided into five broad groups according to the whole-body dose of radiation received and the clinical manifestations exhibited. The first group includes individuals whose dose is under 200 rads. These individuals usually are asymptomatic or at most exhibit mild nonspecific prodromal symptoms. The second group includes those persons who have received a whole-body dose ranging from 200 to 400 rads. The acute radiation syndrome here is mild with transient prodromal nausea and vomiting and minimal laboratory and clinical evidence of hematopoietic damage. The third group is that which has received a dose ranging from 400 to 600 rads. Here, the course is more serious, with hematopoietic damage and gastrointestinal disorders manifested relatively early. The fourth group includes those who have received doses ranging from 600

to 1,400 rads. The acute radiation syndrome under these circumstances is accelerated, with gastrointestinal damage dominating from the beginning. The final group is that with doses in excess of 1,400 rads. The individuals in this category suffer a fulminating course with marked damage to the central nervous system arising within a short time after exposure.

The acute radiation syndrome may be divided into four stages: a prodromal stage, 8 to 48 hours in length, a latent stage of 2 to 3 weeks' duration, an overt illness stage lasting from the second or third week to about the sixth week after irradiation, and a recovery stage ranging to 15 weeks or more in length.

The prodromal symptoms include anorexia, nausea, vomiting, prostration, fatigue, and sweating. If these symptoms begin within a few minutes after exposure, one may expect a fulminating course. This is particularly true if these symptoms become progressively worse in a short period of time. If improvement occurs soon after the onset of the initial symptoms, a more benign course may be anticipated. The physician often finds it difficult to evaluate many of these symptoms because they may be produced by anxiety and apprehension as well as by radiation exposure. It is therefore important that calm and order at the accident scene be restored as quickly as possible after the accident occurs. Isolation of the injured from one another is helpful in the prevention of fear.

Diarrhea in the prodromal stage is an indication that the individual has received a serious radiation dose, probably in excess of 600 rads. Oliguria should similarly be taken to indicate that serious exposure has occurred.

Evidence of damage to the central nervous system is the most ominous of the many clinical symptoms which have been observed. Ataxia, disorientation, and autonomic collapse are three such manifestations which have been followed uniformly by death within a few hours or days.

During the latent stage of the acute radiation syndrome, symptoms often regress to the point where the individual is asymptomatic. The length of the latent period varies from 2 to 3 weeks and is usually shorter when larger doses have been received.

The stage of overt illness may exhibit a variety of symptoms. The principal findings, however, include fever, infection, and purpura as manifestations of hematopoietic damage, diarrhea and paralytic ileus as evidence of gastrointestinal derangement and paresthesia, motor disorders, and autonomic collapse as evidence of injury to the central nervous system. Epilation, lethargy, and weakness also may prevail. Again the extent of these clinical symptoms is a function of the radiation dose.

The laboratory findings of the acute radiation syndrome are particularly valuable in assessing the injury. Studies of blood and bone marrow permit one to determine with some quantitation the extent of the injury. If neutron exposure has occurred, examination of the sodium 24 levels of the blood gives valuable information regarding the magnitude of the dose experienced.

Treatment for the acute radiation syndrome includes strong supportive care with use of antibiotics when infection occurs. Bone marrow transplants with cells from a homologous donor, matched in sex and in major and minor subgroups, have been used by some in the hope that they will restore the hematopoietic systems of patients exposed to severe doses. The value of such therapy is not entirely clear, however, at this time. When considerable inhalation or ingestion of radionuclides has occurred, colloidal ion exchange carriers and chelating agents may be employed to increase the excretion of some of these radioactive materials.

Environmental Exposure Hazards

The exposure of the population from environmental radioactive contaminants poses a substantial problem in terms of both prevention and control for the public health officer. At the present time, environmental contamination is small and is due almost entirely to natural sources. A small component has been added in recent years from the fallout products of nuclear weapons testing. On occasion, malfunctioning nuclear reactors have produced substantial contamination of the environment immediately surrounding these reactors and in the environment downwind or downstream. Fortunately, these accidents have not resulted in

substantial population exposure. As the population of our world increases and as it becomes necessary, therefore, to place reactors closer to centers of population concentration, such accidents will have greater public health significance.

In addition to the regions surrounding reactor sites, environmental contamination may occur about industrial plants where substantial amounts of radioactive material are prepared, processed, or used in various industrial processes. The disposition of waste products from reactor facilities also constitute control problems. It is the responsibility of the public health officer to know the location and use of all radiation sources in his region, to be certain that these sources are being handled correctly and are operating safely, and to be continuously aware of environmental levels of radioactive contamination in the air, water, and soil.

Today's Important Tasks

The National Advisory Committee on Radiation has been reviewing the Public Health Service programs in radiological health to determine those tasks which urgently require attention. It appears that there are eight.

Research

First is the need for additional research in the field of radiation dosimetry. Although a great deal of work has been done in this field by a large number of able investigators in years gone by, much more must be done to provide the instrumentation by which radiation fields may be conveniently plotted in medicine and in industry for the evaluation of radiation risk.

A second important need is additional research to determine the precise metabolic pathways through which specific radionuclides pass when inhaled, ingested, or admitted through the skin. Information provided by this research will help to refine the dosimetry of critical tissues exposed to internal emitters so as to provide a more satisfactory basis of experience and observation for setting permissible limits of contamination. The same information will be valuable to those concerned with the care and treatment of persons bearing a burden of such emitters.

The third task is further research on the relation of radiation dose to biomedical consequences. For the most part, so far, only gross relationships have been investigated, and the quantitative data developed have been meager. A comprehensive study of the influence of many secondary factors on the biological effects of radiation, including the dose rate, and the metabolic status, age, and sex of those exposed, will strengthen the biological basis for permissible dose limits.

A fourth task is that of assessing environmental radioactivity. It may be expected that from time to time in the future, certain regions of our Nation may be contaminated by accidental or deliberate dissemination of radioactive elements. The assessment of current levels of radionuclide distribution, if comprehensive, could be of critical value in determining what control measures may be required in the future.

The possibility of radioactive contamination focuses attention on the need for research in still another direction. This concerns the development of processes whereby food, air, and water supplies may be quickly and effectively relieved of significant radioactivity. Without such techniques of decontamination, a reactor accident may affect enough of the atmosphere, water, and food of a region to impose serious hardship.

Since medical uses of X-rays produce the greatest contribution to the total dose of the population in the United States today, it is important to find methods of reducing such exposure without sacrificing the great benefits of X-ray diagnosis or therapy. Although much is being done along these lines, this aspect of public health requires continuing attention. A sixth important task, therefore, is research on methods of reducing exposure to medical X-rays.

Standard Permissible Limits

The two remaining tasks which I should like to discuss concern radiation standards and the training of public health men for work in the field of radiological health.

Historically, the need for a system of radiation standards or exposure guides for the control of ionizing radiation was first recognized by radiologists and physicians who soon after

the discovery of the X-ray, realized that such radiation presented a number of hazards associated with its use. Precautions were needed to guard patient and physician alike against any substantial amounts of unnecessary exposure. The Advisory Committee on X-ray and Radium Protection (later known as the National Committee on Radiation Protection) was therefore established in the late 1920's to make recommendations concerning safe operating practices in the field of radiology. Through the years, this body, composed of outstanding members of the radiological and associated sciences, has made a large number of recommendations which, as the applications of radiation techniques affected increasingly large groups of people, have been extended to fields of activity well beyond medical radiology.

One of the first recommendations by the committee has become known as the maximum permissible dose (MPD) or the weekly dose which individuals working with ionizing radiation may be expected to receive without the development of serious biological damage. In the beginning the maximum permissible dose was set at a rate of approximately 1 roentgen per week. Over the years, this value has been reduced until now the maximum permissible dose in most situations is only 0.1 roentgen per week.

It is interesting to observe the methods which have been used in setting the permissible maximum. Although the members of the NCRP were of scientific discipline, scientific data were by no means the only consideration. Practical factors have had a profound influence as well. For example, the maximum permissible dose for radiation workers has been reduced over the years not because new information has come to hand which indicates radiation to be substantially more dangerous than once thought to be, but because it has been found that with reasonable operating skill, radiologists and their technicians could easily limit exposure well below 0.1 roentgen per week. Furthermore, such a limit could be observed without added expenditures of time and money. I daresay that if the contrary had been true, the maximum permissible dose would still be at its former level today. This point is emphasized because it is frequently felt that scientific factors alone have determined the limits specified in radiation protective standards. Actually, practical considerations have often played an equally important role.

Since it is prudent to assume that there is no threshold dose of radiation below which biological damage may be avoided, it follows that there is a large philosophical element in the development of radiation protection standards. The specification of a permitted radiation dose in a given standard carries with it the possibility that some biological damage will result when the standard is applied. Hence, those who are charged with the formulation of radiation standards must continually balance biological risk against radiation benefit. If the dosage level is set too high, human damage may outweigh socioeconomic, medical, or other benefit; if the dose is set too low, developments in nuclear science and medicine may be curtailed. These judgments are not without their difficulties because it is necessary to compare unlike quantities when the balance between risk and benefit is evaluated. For example, in occupational exposure, the risks are biological but the benefits may be economic. Certainly, an evaluation of these two factors requires careful judgment of men not only with a sound scientific background, but with broad philosophical insight as well.

As noted earlier, the biological damage produced by ionizing radiation increases progressively as the dose increases. That is, when the dose is small the probability of damage is small, but as the dose becomes larger the probability of damage becomes greater. It therefore follows that when a radiation protection standard covering a given set of occupational or environmental conditions sets forth a maximum possible dose, the standard does not mean that there is complete safety when the dosage levels are below the MPD or that there is complete absence of safety when the MPD is exceeded. Instead, it means that those formulating the standard considered the probability of damage at the maximum permissible level to be so small as to be inconsequential.

In the past, the maximum permissible levels have been set sufficiently low that the probabilities of serious damage either to an individual or to the population at large are small even at dosage levels several times the maximum

permissible dose. It is important that the public and those working in the field of public health appreciate this fact, for it will permit a better understanding of radiation protective measures wherever they may be required. Many times in the recent past, the public has become quite apprehensive when, under certain circumstances, the maximum permissible levels have been approached or exceeded. Such a reaction has not often been consistent with the scientific facts.

The manner in which biological risk increases progressively with radiation dose makes questionable the continuation of radiation protection standards which are expressed in terms of maximum permissible dose. Instead, it seems wise that standards in the future be formulated in a framework in which measures to control radiation exposure become increasingly stringent as radiation dosage levels rise; that is, standards should be based on a concept of graded action to meet increasing risk. Specifically, protective standards should establish a set of guiding principles which include in each case the specification of a lower dosage limit below which biological risk is so small that it may be neglected. Above this limit, the standards should specify a series of dosage levels, each one of which calls for the application of a set of specific public health measures to meet effectively the problems the dosage level imposes. These measures may be expected to become more extensive as the dosage levels increase. Radiation protection standards developed in this manner would not only do much to erase confusion which has resulted from misunderstanding of the term "maximum permissible dose," but would also set the stage for effective public action through a wide range of conditions of exposure.

As an example of how standards based on the "graded action" principle might operate, consider a problem which presented itself in 1960 in several communities because of extensive nuclear testing in the preceding year. The strontium 90 levels in milk rose to substantial fractions of the maximum permissible concentration established by the NCRP. The rise had been rapid and it appeared that the maximum permissible concentration might be exceeded. The prospect of such an event alarmed many people. Although this situation should be and was of concern to public health authorities, it need not have caused public apprehension. Contrary to expressed fears, the risk to the population would not have suddenly worsened if the maximum permissible concentration for strontium 90 had been exceeded. Indeed, these risks would have been only slightly greater than those which prevailed at the levels actually reached.

Nevertheless, with the protective standard for strontium 90 based on the concept of a permissible maximum, a substantial number of people feared that the danger to the population was sufficiently serious that milk supplies should be confiscated. That such a viewpoint was quite unjustified may be illustrated by the fact that intake of milk products containing strontium 90 at the maximum permissible concentration would be required for a period of several decades for an individual to receive a dose to bone approaching the whole-body dose received by properly protected radiation workers during their daily occupation. Since no case of bone cancer has been found in such workers in the past, the public danger from the temporary rise in strontium 90 concentration in milk certainly did not call for the heroic measures that were suggested.

I do not in any way wish to belittle the potential hazards created by fallout. This is not a problem to be considered lightly. However, since risks are proportional to dose, radiation protective standards should not be based on a principle which might be interpreted as calling for no concern below a given radiation level and drastic action above this level. Instead, radiation protective standards should be based on concepts which recognize the scientific facts that increased dosages bring increased risks which in turn call for increasingly stringent controls. The reevaluation of present radiation exposure guides or protective standards seems to be one of the most important matters facing the scientific community in the field of radiation control today.

Training

The last of the eight critical tasks is the training of public health specialists in radiological health.

The requirements for trained personnel fall in two broad categories. The first is a group of individuals whose backgrounds are principally in the physical sciences and who with suitable training in atomic physics, radiation chemistry, and nuclear engineering are able to assume a high order of responsibility in the field of radiation protection design and in the handling of the physical problems associated with accidental exposure of the population. Training programs for these individuals have been in operation for some time under the excellent guidance of the Atomic Energy Commission. Such individuals are usually known under the title, health physicist.

The Public Health Service has also contributed heavily to the training of personnel in health physics. The programs given by the Service, however, have been directed principally to short-course training of supporting technical personnel.

The second category of personnel includes those individuals whose backgrounds are principally biomedical. This group, too, must be capable of assuming a high order of responsibility, but in the broad biomedical aspects of radiological health. Ability to evaluate radiation problems clearly, to make decisions forthrightly, and to lead radiation research and control programs effectively are a few of the characteristics required. We are speaking here of public health physicians who in their fields are as well trained and as capable as the specialists of such fields as surgery, internal medicine, and pediatrics. For convenience, I shall call these men radiation health specialists.

The need for radiation health specialists in this country is particularly acute at the present time because so few have been trained. Almost all the organized training in radiological health has been directed in the past toward the health physicist with little being done to establish programs which will insure adequate numbers of the biomedically oriented. It has been estimated by the National Advisory Committee on Radiation that 1,200 such men will be required in the United States during the next 10 years.

To meet these objectives, there is considerable urgency that proper curriculums for radiation health specialists be established in our schools of public health as soon as possible. Attention is called to the use of the term "proper curriculums." There has been a tendency in some schools of this country to provide the same courses for the radiation health specialist as are given the health physicist. This, I believe, is a serious mistake. The work in physics which is suitable for a physician will be generally unsatisfactory for men with backgrounds in the physical sciences. Also, the biomedical work required for the physician will be much too sophisticated for the engineer or physicist. As a result, if the same curriculum is used for both specialities, the work must be so simplified that it will not attract the best men from either field, nor will it produce individuals who are able to satisfy the requirements of a radiological health program.

At a recent conference on radiological health curriculums sponsored by the Division of Radiological Health at Princeton, N.J., several academic physicists expressed concern that the courses which they were required to present in the field of radiological health were so "watered down" that they found the students ill prepared to assume their prospective duties and responsibilities. The avoidance of substandard educational programs, I believe, can only be achieved by the provision of one curriculum for the health physicist and another for the radiation health specialist. This is not to say that there may be no occasional introductory course which is suitable for both groups. However, the advanced work in atomic physics, radiation chemistry, and nuclear engineering required for the health physicist is quite inappropriate for the radiation health specialist. So, too, the advanced work in radiation biology, radiological biochemistry, and nuclear medicine needed for the radiation health specialist is inappropriate for the health physicist.

It appears that the schools of public health of this country are particularly well suited to provide advanced postgraduate work for biomedically oriented men in the radiation field. With their rich contacts with academic medicine these schools should be able to provide a superb climate for training in radiological health. The challenge is there. I hope it will be accepted. If a serious nuclear accident were to occur tomorrow, I would have little fear that

the physical problems associated with the accident would be taken care of quickly and with distinction by the many well-trained health physicists of our country. I have great doubt, however, that the accident's biomedical problems would be so well handled.

If training programs for radiation health specialists are to be fully effective, it is essential that the climate provided these men in radiological health be stimulating and intellectually interesting. There is nothing more demoralizing to a well-trained man than to find himself working in an atmosphere which limits his opportunity to grow. To insure a satisfactory climate for any biomedically oriented man in public health, two factors must be present. First, the man must have the opportunity to fulfill his aspirations as a physician. For this he must have contact with disease in the laboratory and in the hospital. He must not be relegated to wholly administrative positions where his principal duties are confined to such limited matters as radiation source registration and surveillance. This is not to belittle these important aspects of a radiological health program. However, additional biomedical opportunities must exist for the radiation health specialist if he is to be happy. The second important factor for a satisfactory climate in the radiation field is the provision of adequate research facilities for the investigation of the many problems arising in the field. Not all radiation health specialists will wish to pursue careers in research, but all should be sufficiently close to the research laboratory to benefit from its stimulating rewards.

In many ways, the needs which I have been citing for the radiation health specialist apply equally well to others in public health. Indeed, the absence of a satisfactory climate may be expected to cause deterioration in any public health program. In this connection, it may be well to examine the reasons why public health is not attracting today the best men from our medical schools. There are some who believe that this deterioration in the quality of candidates going into public health is due to a lack of leadership on the part of our schools and health agencies. However, the problem seems more fundamental. Those who work in public health must do so in a climate that is conducive to their growth and stimulation. For most biomedically oriented men, this requires an intimate relationship with the practical problems surrounding the care and treatment of disease. It requires also close association with the research laboratory, with clinical colleagues, and with men in academic medicine.

All of this is particularly cogent for radiation health specialists. Since the fields of radiobiology and nuclear medicine are moving rapidly, it is essential that these men, regardless of position, retain intimate contact with the research laboratory, with the teaching institution, and with clinical services associated with nuclear medicine. This means that the radiological health program developed in State and local health departments should, at the outset, be arranged in such a manner that the professional staff have direct laboratory, teaching, and hospital responsibilities in the regions where they are located.

I should like to make a plea that the health department's laboratories and administrative framework in radiological health be established in close relationship with an outstanding medical environment. Under these circumstances, even those who have onerous but necessary administrative positions may continue to receive the stimulation needed to bring happiness in their positions. This is the pattern which I hope will be followed in the field of radiological health. It perhaps is a pattern which should be followed in many other areas of the public health complex.

BIBLIOGRAPHY

Cronkite, E. P., Bond, V. P., and Dunham, C. L., editors: Some effects of ionizing radiation on human beings. TID–5358. Washington, D.C., U.S. Government Printing Office, 1956.

Finkel, A. J., and Hathaway, E. A.: Medical care of wounds contaminated with radioactive materials. J.A.M.A. 161: 121–126 (1956).

Great Britain, Atomic Energy Office: Accident at Windscale No. 1 Pile on 10 October 1957. London, Her Majesty's Stationery Office, 1957.

Hayes, D. F.: Summary of accidents and incidents involving radiation in atomic energy activities, June 1945 through December 1955. TID–5360. Oak Ridge, Tenn., Atomic Energy Commission, 1956.

Hayes, D. F.: Summary of incidents involving radioactive materials in atomic energy activities, Jan-

uary–December 1956. TID–5360 (supp.). Oak Ridge, Tenn., Atomic Energy Commission, 1957.

Hempelmann, L. H., Lisco, H., and Hoffman, J. G.: Acute radiation syndrome: study of nine cases and review of problem. Ann. Int. Med. 36: 279–510 (1952).

Jones, H.: Life-span studies. *In* Mammalian aspects of basic mechanisms in radiobiology, edited by H. J. Curtis and H. Quastler. Nuclear Science Series Report No. 21. National Academy of Sciences-National Research Council Publication No. 513. Washington, D.C., 1957, p. 102.

Kroll, H., et al.: Excretion of yttrium and lanthanum chelates of cyclohexane 1, 2 transdiamine tetra-acetic acid and diethylene-triamine pentacetic acid in man. Nature 180: 919–920 (1957).

Lewis, E. B.: Leukemia and ionizing radiation. Science 125: 965 (1957).

Mathé, G., et al.: Transfusions et greffes de moelle osseuse homologue chez des humains irradiés a haute dose accidentellement. Rev. franç. études clin. et biol. 4: 226–238 (1959).

Muller, H. J.: An analysis of the process of structural change in chromosomes of drosophila. J. Genetics 40: 1–66 (1940).

Norwood, W. D.: DTPA-effectiveness in removing internally deposited plutonium from humans. J. Occup. Med. 2: 371–376 (1960).

Saenger, E. L.: Radiation accidents. Am. J. Roentgenol. 84: 715–728 (1960).

Thoma, G. S., and Wald, N.: Diagnosis and management of accidental radiation injury. J. Occup. Med. 1: 420–447 (1959).

United Nations Scientific Committee on the Effects of Radiation. Report. General Assembly Official Records, 13th sess., supp. 17 (A/3838). New York, 1958.

U.S. Congress, Joint Committee on Atomic Energy: Public hearings on employee radiation hazards and workmen's compensation before the Subcommittee on Research and Development, Washington, D.C., March 10–19, 1959. Washington, D.C., U.S. Government Printing Office, 1959.

Upton, A. C.: Ionizing radiation and the aging process. J. Gerontol. 12: 306–313 (1957).

Upton, A. C., et al.: Some delayed effects of atom-bomb radiations in mice. Cancer Res. 20: 1 (1960).

Health Needs of the Aged

It is well-nigh impossible to gather statistics on the care people fail to get. There are indications, however, that many old people are prevented by the cost of hospital services from getting as much care as they ought to have. Utilization generally goes up when a new source of financing is provided—for example, through a public assistance health program. Insured people use more care than uninsured. These facts indicate that financial barriers do stand in the way of care—and in my opinion of needed care, for my own belief is that physicians do not send many people to hospitals for care they do not need.

Let me make sure that you recognize the difference between saying that no one is denied hospital care and saying that no one, for financial reasons, goes without hospital care that he ought to have. It may be largely true, as is often stated, that no one in need of care is turned away from our hospitals for inability to pay. But we must not forget those who are too proud to ask for charity, those who will postpone indefinitely dipping into their little savings, those who cannot bring themselves to burden the limited resources of their children. Who is to say how much hospital care is foregone or how many tragedies flow from its postponement because old people are unwilling to face the financial consequences of seeking the care that they need?—*Excerpt from an address by Alanson W. Willcox, General Counsel, Department of Health, Education, and Welfare, at the annual convention of the Texas Hospital Association, Dallas, May 16, 1961.*

596165—61——3

Program Notes

A unit in which persons who have been accidentally exposed to radioactive substances will be scrubbed and decontaminated before receiving medical treatment has been set up in the Fairview Park Hospital in Cleveland, Ohio. More than 150 industries and agencies in this metropolitan area use radioactive materials.

« »

New York State put its first mobile air sampling unit into operation recently. It will be used to investigate pollution complaints and will be available for loan to county and municipal health departments.

« »

Blood studies of residents of five New Jersey communities show that about 2.2 percent of the population were infected with eastern encephalitis in the 1959 outbreak. However, only 1 out of every 18 persons infected developed sufficient symptoms to lead to a diagnosis.

« »

Maryland's department of mental hygiene estimates that nearly $30 million has been been saved by the decline over the past 5 years in the average daily number of patients in its mental hospitals per 100,000 Maryland residents. The rate declined from 414.2 in 1955 to an estimated 344.6 in 1961.

« »

At least 37 State health departments are expanding staff to improve nursing home services with the support of Federal grants.

« »

Responsibility for Kentucky's program on alcoholism has been transferred to the department of health from an independent commission on alcoholism. Members of the former commission will serve as advisers.

« »

Eleven accident prevention rules for trampoline tumblers are offered by the Greater New York Safety Council.

"Procedure for Investigation of Food-Borne Disease Outbreaks," published by the International Association of Milk and Food Sanitarians in 1957, has been distributed to more than 11,000 health agencies, educational institutions, and food service establishments. It is used by food establishments to improve employees' understanding of the nature of food-borne diseases. Single copies of the 32-page document sell for 50 cents.

« »

Central Islip State Hospital on Long Island, N.Y., opened a unit for treatment and rehabilitation of narcotic addicts in April 1961. The unit has a 30-bed ward for intensive detoxication treatment and a 50-bed ward for continued treatment and rehabilitation.

A similar unit will soon be established at Utica State Hospital to serve upstate New York.

« »

An institute for basic research in mental retardation will be established by New York State on Staten Island, adjacent to the Willowbrook State School.

« »

A recreation and guidance center in Prince Georges County, Md., for former patients of mental hospitals is the goal of the county mental health society. The center's staff would consist of a paid professional director and volunteer psychiatric workers supplemented by lay persons who have completed a 2-year course in group therapy. Clubs for ex-patients have been organized recently in Shreveport, La., and Columbia, S.C.

« »

A leaflet titled "Hold His Hand" lists rules parents should follow in supervising and training their children in order to prevent traffic accidents. The leaflet was prepared and distributed by the Baltimore City Health Department, the Maryland Traffic Safety Commission, and the Safety Engineering Club of Baltimore.

The true causes of fatal auto accidents are often unsuspected, according to evidence collected by a Harvard Medical School research group and reported by Don Ross in the *New York Herald Tribune* (March 13, 1961). Alfred Moseley, a psychologist, and Dr. Richard Ford, chairman of the department of legal medicine, are directing the group, which is now in the second year of a 5-year study supported by a $810,000 Public Health Service grant.

The investigators have found that in some fatal accidents reported by the police as "driver asleep," the driver had actually tried desperately to avoid crashing. Evidence indicating possible suicide was uncovered in other cases. Chronic illnesses that can interfere with safe driving were factors, often very subtle ones, in a number of accidents.

Autopsies of victims, immediate physical examinations of survivors, detailed studies of accident locations, and periodic compulsory inspection of motor vehicles were recommended by Moseley and Ford on the basis of their studies so far.

Ross reported also on a recently completed Northwestern University study directed by J. Stannard Baker, which concludes that automobile accidents result from combinations of factors. Baker's group has compiled a list of 800 such factors.

« »

Sales of bottled spring water and distilled water have been rising; in 1960 they totaled $30 million. Officials of bottled-water companies say that increased sales of spring water can be attributed in part to the unpleasant taste of chemically purified public water in many areas. Many persons on low sodium diets are drinking distilled water. A Los Angeles company is adding fluoride to some of its bottled water.

« »

Kitanning, Pa., is planning a $500,000 waterfront recreation area on the banks of the Allegheny River, now that it is relieved of the untreated sewage of upstream communities.

Control of Common Radiation Hazards in New York City

LEONA BAUMGARTNER, M.D., and HANSON BLATZ

THE NEW YORK CITY Department of Health has had many years of experience in dealing with certain specific radiation problems. Registration of X-ray laboratories has been required for more than 30 years. A study of and an attempt to control shoe-fitting fluoroscopes and the sale of luminous-dial watches containing excessive amounts of radium have been undertaken. Followup of complaints and inquiries regarding possible misuse or improper installation of medical, dental, and veterinarian X-ray equipment have long been regular activities of the public health sanitarians. Recently, as concern over exposure to radiation has increased, our health department, like many others, has expanded its activities.

Basic Legislation

After a careful study of legislation proposed by various groups, the New York City Board of Health in March 1958 adopted a new section of the New York City Sanitary Code intended to cover all radiation hazards. (With some modification, the radiation code was included in the New York City Health Code (*1*) enacted in 1959.) This code differs from most other radiation legislation in authorizing a fee for registration of radiation sources. Besides helping to finance the program, the fee has, we believe, resulted in registration being taken more seriously. Preliminary meetings were held with radiation experts and with professional and business groups that would be affected to obtain the widest possible discussion and acceptance of the code before its adoption.

The radiation code authorizes use of the widely accepted recommendations of the National Committee on Radiation Protection (NCRP). Its wording is such that future modifications of the NCRP recommendations automatically become part of the code. At the same time, it permits exceptions to the NCRP recommendations or changes in emphasis where incompatibility with any local public health policy might result.

Organization and Staffing

Because of its expected size and its highly technical nature, we decided to conduct the program with a carefully organized and trained staff of radiation specialists whose work would be limited to radiation inspections, rather than to add the work to the many other activities of the sanitary inspectors. As far as we know, only one other State or local radiation control program follows this policy.

An office of radiation control was set up as an integral part of the health department. Field staff were recruited from among those sanitarians in the department who had a college degree in science or its equivalent. The director and assistant director have had extensive experience and training in the radiation field. By special arrangement, the director has been given an appointment in the Environmental Radiation Laboratory of the New York University Institute of Industrial Medicine.

A commitee of technical experts in radiology, radiological physics, industrial hygiene, civil defense, atomic energy, and dental radiology was set up as an advisory group. It was made advisory, however, not to the health department,

Dr. Baumgartner is commissioner of health for New York City, and Mr. Blatz is director of the office of radiation control of the New York City Department of Health.

but to the mayor, since other city departments are also concerned with radiation hazards.

Because of the interest of many city agencies in radiation control, the mayor also appointed an Interagency Council on Radiation composed of the commissioners or other representatives of the fire, police, hospitals, water supply, public works, marine and aviation, and health departments, and the office of civil defense. Coordinating activities are usually carried out by action committees made up of technical representatives of the agencies concerned with specific problems. For example, the Emergency Action Committee consists of representatives of the health, fire, and police departments. Another committee, concerned with possible radioactive contamination of the city's water supply, includes representatives from the health department, department of water supply, gas, and electricity, and the board of water supply (the city's overall water supply planning agency).

The city administrator is chairman of the Interagency Council on Radiation. The mayor's Technical Advisory Committee advises the council, and the health department's office of radiation control gives technical guidance. This combined organization has worked well and has served to avoid duplication of radiation control activities by the various agencies.

Establishment of the office of radiation control has had an additional advantage, that is, improvement in communication with the local press. Reporters have learned that they can quickly get factual information from the director, with the result that newspaper stories are more objective and more accurate than in the past. Not one of several recent incidents involving actual or suspected radioactive materials (for example, recovery of a capsule of radium in a sanitary landfill or disappearance and recovery of a scientific exhibit item containing radioactive material) received scare-type publicity. A few of the incidents were given brief public-interest notices after the cases were solved.

Registration of Sources

Recognizing that accurate knowledge about all sources of radiation is basic to any control program, we began with collection of data on their nature, location, and manner of use. Registration requires completion of a carefully planned questionnaire as well as payment of a $15 fee. The data obtained have been put on punchcards to expedite handling and programing.

From registration data obtained by January 1, 1960, we estimate that there are some 20,000 individual sources of radiation in New York City. Counts of the principal kinds of X-ray machines at registered installations give a total of 16,439 units, as shown in the following tabulation. (The medical units include those owned by podiatrists and osteopaths. A radiographic-fluoroscopic combination unit is listed in both categories.)

	Number of units
Medical fluoroscopes	5,268
Medical radiographic units	4,619
Dental units	6,552
	16,439

In addition, 214 deep therapy installations, 70 veterinarian installations, 416 radioisotope users, and 140 radium users are registered. The actual number of sources at these installations is not yet known, but many of the deep therapy and veterinarian installations have more than one X-ray unit, and the radioisotope and radium users generally have multiple sources. About 8 percent of the radioisotope users and 24 percent of the radium users are industrial.

A breakdown of the registered radiation installations, excluding industrial installations, by owner category is as follows:

	Number of installations
Dentists	6,409
Physicians	5,128
Podiatrists	442
Hospitals	343
Veterinarians	70
Osteopaths	65
Chiropractors	6
Total	12,463

Chiropractors, currently involved in litigation regarding authority to use X-rays, are the only group not registered essentially 100 percent. We estimate that there may be as many as 500 chiropractors using X-ray equipment.

Even though the registration requirement was widely publicized through press and radio and professional and business groups, it took almost a year and a half to attain complete registration. Many hundreds of personal visits and telephone calls were made to those who had not responded to several notices informing them of the need to register. Apparently the difficulty was in communication, for there was little resistance once contact was made. The medical societies requested each member who had not registered to do so; in fact, they as well as the dental societies have approved the radiation control program generally.

The $15 fee covers registration for 2 years. Payment of $10 is required biennally thereafter. In order to keep registration up to date, the radiation code has been amended to require dealers and manufacturers to notify the department of health within 10 days after delivery or installation of radiation equipment. Experience indicates that such notifications are being received regularly.

Establishment of Priorities

The NCRP and its many subcommittees have made hundreds of recommendations applying to a wide variety of radiation sources and circumstances. We decided that, at least for the first few years of the program, we would consider only the mandatory recommendations, that is, those using the word "shall."

Each of the applicable "shall" recommendations was listed, and the potential hazard it was intended to control was evaluated by estimating the likelihood of a radiation exposure occurring if the recommendations were not heeded and the severity of the exposure if it should occur. An estimate was also made of the number of persons likely to be subject to such overexposure.

Reports on radiation exposure in the literature (for example, *2–5*), as well as our own radiation registration findings, indicate that by far the most important consideration in radiation control is the exposure of medical and dental patients during routine X-ray examinations. Of an estimated 20,000 sources of radiation in New York City, at least 16,500 are medical and dental X-ray machines. There are only 416 licensed radioisotope users and 140 radium users, although the number of individual sources of radiation in these categories is considerably greater.

The Federal Radiation Council reported in 1960 that of 66,000 radiation workers employed by AEC contractors, only 17 received radiation doses exceeding the so-called maximum permissible limits (*6*). Of those 17, 12 were in serious radiation accidents that could occur only at certain development laboratories concerned with the design and testing of weapons components or reactor fuel elements. The problem is not the sort with which a local health agency would normally be concerned.

In contrast, estimates of the number of patients exposed to diagnostic X-rays in the United States are of the order of hundreds of thousands a day. Reports by the National Academy of Science (*2*), the United Nations Committee on Radiation (*3*), and the Federal Radiation Council (*6*) indicate that medical and dental use of X-rays constitutes an estimated 96 percent of all manmade radiation to which the population is exposed. These reports also show that this source accounts for an integrated population dose (average per capita dose of genetic significance) estimated to be at least 25 times as great as the total integrated dose to the population resulting from the entire atomic energy industry. Thus, any reduction in exposure to medical and dental X-rays, even though it be very slight, would be much more significant in reducing the total population dose than an equivalent degree of reduction in occupational exposure.

Except for rare accidents or occasional gross negligence, there is little evidence that industrial workers are receiving radiation doses in excess of the conservative limits established by the NCRP. There is much evidence, however, to indicate that many medical and dental patients receive more radiation than is actually necessary for a particular X-ray examination. This does not mean that the number of examinations need be reduced but that each examination be done with equipment and techniques that keep the dose as low as possible. We believe, therefore, that assistance to physicians and dentists in reducing radiation exposure constitutes the most valuable public health con-

tribution in radiation control today. Major attention has been given to this goal in the New York City program.

Medical and Dental Equipment

The recommendations of the National Committee on Radiation Protection relating to medical and dental X-ray equipment (*7*), now included by reference in the New York City Health Code as rules, concern the unnecessary or excessive exposure of three groups: patients, operators of the equipment, and persons living or working near X-ray installations. As previously emphasized, the first group is certainly the largest, and it is to this group what we have so far directed our major efforts, although some attention has also been given to the other two.

In preparation for the inspection program, the most serious deficiencies in X-ray equipment design, installation, and use were listed, and standards were formulated against which equipment or techniques could be measured. A standard operating procedure and a checklist were developed for inspecting each type of X-ray installation, including medical diagnostic X-ray, medical therapeutic X-ray, mobile or portable X-ray, fluoroscopic X-ray, and dental X-ray installations. All the inspection criteria were reviewed and approved by the mayor's Technical Advisory Committee.

An initial group of public health sanitarians, all with inspection experience, were then taken to the showroom of one of the local X-ray dealers and to one of our largest city hospitals for intensive training in inspecting X-ray equipment. These sessions were supplemented by classroom lectures and demonstrations covering the principles of radiation protection.

Major Deficiencies

So that the most serious hazards can be corrected as soon as possible, each installation is given a preliminary inspection limited to basic faults, and secondary matters are relegated to followup inspections.

The first inspection consists of a visual examination against a standard checklist. No radiation detection instruments are used. A fluorescent screen is used to determine the area covered by an X-ray beam, a very important criterion of the exposure dose. The screen is also used to determine any gross deficiency in shielding; for example, replacement of protective lead glass by a piece of ordinary plate glass. A special gauge for measuring aluminum filter thickness and a tape measure for several other measurements are the only equipment necessary. The checklist covers such items as the size of the X-ray beam used, for example, in chest radiography and in radiography of extremities, filter thickness, distance from fluoroscope tube to panel, limits of fluoroscopic shutters, and relation of the X-ray control and radiographic exposure switch to operator's shield.

The X-ray equipment operator (technician or physician) is asked to demonstrate a few common techniques, mainly to determine what size X-ray beam is used. The inspector acts as the patient, except that no exposure is made. The following beam diameters are used as guides in determining when the beam is larger than clinically necessary:

Film size (inches)	*Film diagonal (inches)*	*Beam diameter (inches)*
8 by 10	12¾	15
10 by 12	15½	17½
11 by 14	17¾	20
14 by 17	22	24

Experience has shown that when these or smaller diameters are used, corner cutoff will frequently appear on exposed films. Absence of such cutoff in all films generally indicates inadequate collimation.

In addition to marking the checklist, the inspector sketches, on the back of the form, a scale drawing of the X-ray room and the location of the equipment and the controls. He also indicates the nature of the occupancy of all adjacent areas. For installations where structural shielding appears to be critical, but where there is no positive evidence that it is actually installed, the inspector notes this fact for a followup test. Inability to measure readily both the fluoroscopic filter and distance from tube to panel or any indication that lead glass or a protective tube housing is inadequate also calls for special notation.

If necessary, a second inspection is made of fluoroscopic equipment to measure the dose rate. This measurement is required, we believe, only

when the filter thickness and the tube-to-panel distance cannot be measured or when the voltage and current settings cannot be reasonably estimated. Actual measurements of a sample of the equipment on our list indicates that it is only when these factors cannot be determined that the fluoroscopic dose rate can differ by more than about 25 percent from the value given on standard X-ray output tables.

In choosing which equipment to inspect first, certain priorities were obvious: machines used most frequently (those in large hospitals, for example), machines used with heavy dosage, and machines built before modern safeguards and structural shielding were common. Equipment used in the examination of children and pregnant women will be inspected next.

This streamlining of the program, plus, of course, the geographic compactness of the area, has enabled each inspector to complete five inspections a day. In the first year and a half, more than 4,000 visits have been made by a staff of two or three inspectors. Spot reinspections indicate that these preliminary inspections have led to elimination of many of the most serious deficiencies. The following tabulation, based on 1,000 inspections of dental equipment and 2,500 examinations of medical equipment, shows the extent of three deficiencies.

	Percent of dental units	*Percent of medical units*
Excessive beam size	30	64
Inadequate filter	35	20
Inadequate operator protection	2	51

At first we found that some surgical supply houses (as distinguished from the major X-ray manufacturers, who usually sell directly in our area) were installing medical and dental X-ray equipment that did not meet the basic safety standard or was not being properly installed. The New York City Health Code fixes responsibility for these matters with the seller. Prompt followup has served to inform suppliers of the standards they must meet and has resulted in much improvement in recently installed equipment. For example, we never see an X-ray table and control installed side by side without shield for the operator, although this arrangement was common in the past. The suppliers' responsibility is, we believe, a unique feature of our program.

Structural Shielding

A third inspection is made if the initial inspection report indicates a need for a test of structural shielding, particularly when the shielding is intended to protect adjacent rooms not under control of the owner or operator of the equipment. This test is made by a team specially trained for the job. The recommendations of the NCRP and those of the Federal Radiation Council are quite specific and conservative in limiting the dose to occupants of areas not controlled by the owner or operator of an installation. The very low limit of ½ rem per year has recently been established.

Investigation of structural shielding may present difficulties in public relations. The neighbor sometimes does not know he is located adjacent to a source of radiation, and often he cannot fully understand that even under the most conservative standards there will be detectable radiation in his quarters. It is often desirable, therefore, to conduct such evaluation without entering the neighboring areas. If the adequacy of shielding cannot be determined simply by inspection or by test borings, the owner of the equipment is responsible for proving that shielding has been installed by submitting building plans or some other evidence. Often, where the existence of shielding cannot be proved, the addition of 1 or 2 mm. of lead shielding is preferable to making measurements in the next apartment or building.

At present, we are investigating the feasibility of determining the adequacy of lead shielding by radiation-scattering devices. These instruments have been used for determining soil density, the presence of certain materials under the ground, and the nature of certain unknown materials. We believe that the presence of lead shielding can readily be determined by such a method, but it is not certain that its thickness can be determined with a sufficient accuracy or facility. When access to the adjacent property can be gained, shielding is tested with an iridium 192 source and scintillation detectors.

Radium and Radioisotopes

Proper use, storage, and handling of radium, usually in hospitals, is the second aspect of the

radiation control program. Paraphrasing recommendations of the NCRP (*8*), we prepared a guide for radium users. This guide requires the owner to appoint a source custodian who is responsible for a careful accounting system.

He must have authority to approve or disapprove the withdrawal of radium for use, and he must keep a record showing the whereabouts of the material at all times.

Radium users must provide adequate facilities for secure and well-shielded storage of the material, a suitable place for its preparation and cleaning, and appropriate handling tools, shields, and transport containers. We plan soon to institute standard periodic tests for damaged or leaking radium tubes or needles.

These requirements, we believe, will correct the two most common radium hazards: misplacement or loss of the material and leakage of radium or radon gas from damaged units.

At present, the Atomic Energy Commission conducts an extensive inspection program in connection with its distribution of reactor-produced radioisotopes. The health department therefore has felt no major concern for the handling of these materials. However, current negotiations are expected to result in transfer of the licensing and regulation of users of radioisotopes and of small amounts of source materials (uranium and thorium) and fissionable materials in this area from AEC control to local control. This responsibility can easily be assumed by our program with a small addition to our staff.

Radioactive Wastes

Each of the hundreds of users of radioactive materials in the city constitutes a potential source of environmental contamination, either through air pollution or through normal disposal of radioactive wastes. Although there is no reason to believe that either of these is at present a significant source of exposure, both will bear watching. Radioactive contamination of the environment (air, water, or soil) cannot readily be removed, particularly contamination by long-lived radioactive materials.

Our program is currently investigating local waste disposal methods. So far, we have found no practice requiring correction. As the use of radioactive materials becomes more widespread, however, it may be necessary for public health agencies to take a more conservative position regarding waste disposal.

In general, use of radioactive materials in industrial plants in New York is supervised by the State department of labor. The few industrial locations within New York City handling enough radioactive materials to constitute a significant source of radioactive contamination of the air are being kept under surveillance. The Atomic Energy Commission and the State department of labor tell us of any new users in the city.

Transportation of Radioactive Materials

New York City's concern with transportation of radioactive material is unique in the United States, if not in the world. As part of the U.S. program of support for atomic development throughout the world, the Atomic Energy Commission ships much nuclear fuel to other countries and eventually receives all of it back in the form of spent fuel elements that are returned for chemical processing and for the separation of fission products. The spent fuels in particular could constitute a significant hazard if involved in an accident or fire. Fissionable materials in supercritical quantities are also possible sources of trouble if mishandled.

Most of the nuclear fuel shipped out of the country passes through New York City. Several incidents involving this material have occurred in the past few years, usually in connection with its transfer from railroad, truck, or airplane on which it is shipped into the city to airplane or ship for the trip overseas. There were no serious consequences, but many of the incidents attracted widespread attention in the press and caused considerable alarm.

A review of transportation accidents and fires which have occurred throughout the country discloses no evidence that anyone has ever been exposed to excessive radiation as result or that there has been any great damage as a result of radioactive contamination. The risk of radiation exposure resulting from a transportation accident therefore appears slight. Never-

theless, primarily to prevent the public apprehension any such incident would cause, we believe that such city agencies as the fire, police, and health departments should know in advance whenever a hazardous shipment is to be made into or through the city. The health code requires prior notification of all such shipments, as well as notification of any accident, incident, or overexposure in any situation. The Atomic Energy Commission and its various contractors and licensees engaged in the shipment of such materials have given us excellent cooperation in this regard.

Radioactive Fallout

Except for periodic measurements of the amount of radioactivity in our water supply and of external radiation levels, our program has not been particularly concerned with radioactive fallout. The extensive programs of the Public Health Service and the Atomic Energy Commission indicate that, at present, fallout does not constitute a serious public health hazard, in comparison with other sources of radiation to which the population is exposed. We are concerned only with any gross changes in fallout that might indicate the need of a further investigation. If background radiation resulting from fallout were to increase generally, we would certainly learn of it from the national networks. Unless radioactivity does increase very greatly, there is little that a local health department can or should do.

To allay undue public fears, we have put together in layman's language a statement concerning strontium 90 in milk (*9*). This statement has been widely used in answering queries and for distribution to parents' groups and others. Keeping a balance on the hazards of radioactive fallout in combating radiophobia is a challenge to health departments that should be met decisively.

Research and Evaluation

Through its management analysis and research units, the health department is watching the new radiation control program. Eventually, these units plan to develop evaluation indices and performance standards on routine activities.

Close association between the health department and the Environmental Radiation Laboratory of the New York University Institute of Industrial Medicine has made possible more formal research planning than would have otherwise been possible and has proved of mutual benefit to the two institutions. Currently, a joint project, supported by the Public Health Service and undertaken in cooperation with the Sloan-Kettering Institute, is concerned with actual exposures during medical X-ray diagnosis. Arrangements have been made through the local county medical societies to keep accurate exposure records of all radiographic and fluoroscopic examinations for a carefully selected sample of each medical specialty using X-rays. Details as to exact techniques and exposures will be recorded and related to dose measurements in the laboratory on phantoms under conditions as nearly like those of actual use as possible. From these data, integrated tissue dose (the so-called integral dose, in gram-rads), bone marrow dose, and gonad dose per capita as well as average dose per examination can be estimated.

To help evaluate the fluoroscopy records, a subsidiary project is studying exposure during fluoroscopic examinations. Large X-ray sensitive films are used to measure the cumulative dose of radiation entering the patient's body during fluoroscopy by fastening the film to the panel of the fluoroscope prior to the examination. After development, the film is measured on a special densitometer. By indexing the films to the points of reference, such as the hips or shoulders of the patients, the dose to various organs can be determined.

Summary

New York City has developed an extensive radiation control program over the past few years. The program is interdepartmental, with major responsibility vested in the health department. A new section of the New York City Health Code, enacted by the board of health in 1959, requires registration of every source of radiation in the city and notification of hazardous shipments of radiation materials, of all newly installed radiation installations, and of accidents, incidents, and overexposures.

Emphasis has been placed on helping physicians and dentists to reduce to a minimum the radiation dose to patients from X-ray equipment. This source of radiation constitutes an estimated 96 percent of all manmade radiation to which the population is exposed. In our experience, it has been possible to reduce this hazard significantly.

The New York City program has also taken steps to control the use of radium and is preparing to deal with problems of radioactive isotopes, transportation of radioactive materials, disposal of radioactive wastes, and fallout as the need becomes evident.

REFERENCES

(*1*) New York City Board of Health: New York City health code. Article 175. Radiological hazards. New York, 1959, pp. 401–412.

(*2*) National Academy of Sciences–National Research Council: The biological effects of atomic radiation. Summary reports. Washington, D.C., 1956, pp. 20–23.

(*3*) United Nations Scientific Committee on the Effects of Atomic Radiation: Report. General Assembly Official Records, 13th sess., supp. 17 (A/3838). New York, 1958.

(*4*) Great Britain Medical Research Council: The hazards to man of nuclear and allied radiations. London, Her Majesty's Stationery Office, 1956.

(*5*) Brown, R. F., Heslep, J., and Eads, W.: Number and distribution of roentgenological examinations for 100,000 people. Radiology 74: 353–363, March 1960.

(*6*) U.S. Federal Radiation Council: Back-ground material for the development of radiation protection standards. Staff report No. 1. Washington, D.C., U.S. Government Printing Office, 1960.

(*7*) U.S. National Bureau of Standards: X-ray protection. Handbook 60. Washington, D.C., U.S. Government Printing Office, 1955.

(*8*) U.S. National Bureau of Standards: Protection against radiations from sealed gamma sources. Handbook 73. Washington, D.C., U.S. Government Printing Office, 1960.

(*9*) New York City Department of Health: Toward a public health perspective on strontium-90. New York, April 19, 1960.

Drinking Drivers

A "tough" policy to counteract the flood of traffic deaths and injuries caused by drinking drivers is urged by Dr. Seward E. Miller, director of the University of Michigan Institute of Industrial Health and formerly with the Public Health Service. He says, "We can begin by finding a better word than 'accident.' An 'accident' implies that the event is out of the hands of the driver. But drunken driving is entirely the personal responsibility of the driver, and he should be held firmly accountable for his acts."

In the May–June issue of *Police*, Dr. Miller recommends:

- A strong campaign to declare drunken driving a serious crime against the public safety.
- Correction of existing laws so that drunken driving is judged on the basis of modern scientific knowledge.
- Adoption of new laws to provide severe penalties for drunken driving.
- Rigid enforcement, staunch public support of the police agencies, and an end to popular mollycoddling of drunks.

Dr. Miller points out that present laws of most States consider an individual "under the influence" only when his blood alcohol test is above 0.15 percent. Recent experiments show driving ability is impaired at about 0.04 percent alcohol in the blood.

In urging the attack on drinking drivers, Dr. Miller states that "evidence has been piling up for years pinning the cause of accidents on the individual. We must get the concept across that driving is a privilege to be prized and cherished, and that when an individual behaves in a way that endangers public safety he should be denied the privilege of driving.

"In about 50 percent of fatal automobile accidents a drinking driver is involved. If we had such clearcut evidence about the cause of cancer, there would be a booming public outcry to put an end to it."

Isolation of Histoplasma capsulatum From Soil in Washington, D.C.

CHESTER W. EMMONS, Ph.D.

IN THE FALL of 1960, *Histoplasma capsulatum* was isolated from 10 of 10 specimens of soil collected in a small park in downtown Washington, D.C. In order to clarify and emphasize the significance of the demonstration that this pathogenic fungus grows freely in urban as well as rural habitats on the Atlantic seaboard, it is necessary to review some of the history of *Histoplasma* and histoplasmosis.

H. capsulatum was isolated from a saprophytic source for the first time in 1948 (*1*). Both the local site and the geographic area from which the first positive soil specimen came are historically and scientifically significant. This specimen was collected near the entrance to a rat burrow under the edge of a chickenhouse in Loudoun County, Va. Later isolations of *H. capsulatum* from soil taken from many farm premises in both northern Virginia and eastern Maryland (*2*), the report of four fatal human cases of histoplasmosis in northern Virginia in 1946 (*3*), the discovery that in this area seven species of animals are natural hosts of *H. capsulatum* (*4*), and the observation that as many as 83 percent of persons in one intensively studied community are hypersensitive to histoplasmin (*5*) conclusively demonstrate that *H. capsulatum* is a frequent contaminant of man's environment and that histoplasmosis is a common disease and an important medical problem on the Atlantic seaboard. Some workers, in discussing the epidemiology of histoplasmosis, have persistently ignored these facts.

Dr. Emmons is head of the Medical Mycology Section, Laboratory of Infectious Diseases, National Institute of Allergy and Infectious Diseases, Public Health Service. (Paper received Feb. 6, 1961.)

Epidemiologic studies of many cases of histoplasmosis in residents of the District of Columbia have included searches for *H. capsulatum* in the urban environments of the patients (*2*). Up to the time of this study no isolations of this fungus had been reported from soil collected within the District of Columbia. We had isolated the fungus many times from soil (usually around chickenhouses) to which District of Columbia resident patients had been exposed during visits or temporary residence in nearby Maryland or Virginia.

Because of persistent confused or erroneous concepts expressed in the literature of the mycoses, the epidemiology of histoplasmosis cannot be discussed without reference to the epidemiology of cryptococcosis. The present study, although it resulted in isolations of *Histoplasma*, was directed toward a search for *Cryptococcus neoformans*. The first reported isolation of *C. neoformans* since 1896 from a source unrelated to human or animal infection was also from the Washington, D.C., area (*6*). This report was followed by the demonstration that *C. neoformans* is a frequent inhabitant of accumulations of pigeon droppings in old nests or beneath roosting sites under conditions in which this material has not become composted with soil (*7*). This purely saprophytic association between virulent strains of *C. neoformans* and pigeon droppings has been confirmed in several parts of the world and in Washington, D.C., by repeated examinations of such material collected from the attics of old school houses, cupolas on school houses and other public buildings, the ledges outside windows of office buildings, and many similar locations (*8*). Both *H. capsulatum* and *C. neo-*

formans, therefore, are commonly present in man's environment in the Washington, D.C., Maryland, and Virginia areas.

I have continued to look for *C. neoformans* in Washington and particularly in the soil of city parks. It is assumed that *C. neoformans* probably is present in the soil of city parks frequented by pigeons, and although examinations of specimens so far have failed to demonstrate it, the search has been continued. Collected specimens have always been examined by methods known to be adequate to demonstrate the presence of *H. capsulatum*, should it also be present.

Materials and Methods

Specimens were collected as described in previous papers (*9*) by scooping up the superficial layers of soil directly into large test tubes (22 by 150 mm). Portions of each specimen were removed in the laboratory to similar sterile tubes. Physiological sodium chloride solution was added in the proportion of about 5:1. Each tube was stoppered with a sterile rubber stopper and shaken vigorously. An 8-ml. portion of fluid was taken from the upper part of the liquid column after sedimentation of solid material; 2 ml. of an antibiotic solution (2 mg. streptomycin and 5 mg. penicillin per milliliter of water) were added to the 8 ml. of soil suspension, and 1 ml. of this mixture was injected intraperitoneally into each of five mice. Mice were killed 1 month later, and portions of spleen, omentum, liver, and any abscesses or lesions which were observed were placed on modified Sabouraud's agar by mincing a tissue on the agar slant with the scissors by which it was taken from the organ. The tissues were spread with a stiff loop and the exertion of pressure, and the cultures were incubated at 30° C.

Results

Without reviewing the specimens of park soil collected during previous years and from which no significant fungus isolations were made, this report is concerned with collections made during the fall of 1960. Ten specimens were taken from a park about 2 acres in size. This park is traversed by numerous paths near which benches are located, and it usually contains many pigeons. No significant isolations were made in this area.

Ten additional soil collections were made on the same day from a small park adjacent to Pennsylvania Avenue NW. This park contains a few paths and benches and numerous sycamore trees. The park is well kept, and when these collections were made it had been raked and cleaned recently. It appeared that litter and other material on the surface had been scraped up and removed that morning. There was no conspicuous evidence of bird droppings, although this is known to be an important roosting area for a concentration of starlings (*Sturnus vulgaris*). *H. capsulatum* was isolated from all 10 of the specimens of soil collected from this small park. *C. neoformans*, the fungus actually being sought, was not found.

Five specimens were taken from an area adjacent to the street pavement near the intersection of Massachusetts Avenue and E Street NE., under pin oak trees. This was an area which showed little promise of yielding a pathogenic fungus. The soil contained gravel and cinders, was eroded by rains, and at the time showed little evidence of contamination by bird excreta. However, *H. capsulatum* was isolated from one of the five specimens collected at this site.

Discussion

In general the most productive type of location for isolation of *H. capsulatum*, both before and after Zeidberg and co-workers (*10*) called attention to this association, has been in, under, or near chickenhouses. There have been isolations from other locations, some of them associated with bird habitation and some without any obvious association of this type. These have been reported or reviewed by numerous investigators (*11–14*). Another association, the presence of *H. capsulatum* in decayed bat guano in caves, has been demonstrated by many investigators (*15–20*). A family outbreak of histoplasmosis with one fatal case was reported from Maryland by Emmons (*9*). On the premises occupied by the family, no chickens had been

kept for many years, but *H. capsulatum* was isolated repeatedly at all seasons of the year adjacent to the basement wall of the house where the soil was contaminated by droppings of the house bat (*Eptesicus fuscus*). These habitats from which *H. capsulatum* has been isolated, although varied, were essentially rural or in small villages. A possible role of the house bat in the epidemiology of urban histoplasmosis was suggested, however (*9*).

Ajello's report of a school outbreak of histoplasmosis, in which manure from a grackle (*Quiscalus quiscula*) roost was used to enrich soil for a gardening project, associates this bird with the saprophytic occurrence of *H. capsulatum* (*21*). I have failed in two attempts to isolate *Histoplasma* from a large grackle roost 75 miles from Washington, probably because sampling has been inadequate. It is probable that further studies will show additional associations of the types mentioned above.

The occurrence of urban hypersensitivity to histoplasmin with probable urban exposure to *Histoplasma* has been reported by Aronson and Edwards (*22*). An outbreak mentioned by Larsh (*23*), to be reported by Furcolow and associates, demonstrated an association between an urban starling roost and several severe cases of histoplasmosis (*24*). The source of infection was on an old, neglected, 11-acre estate, overgrown with vines, weeds, and trees in Mexico, Mo. Although urban in location it was actually a densely wooded area. Histoplasmin sensitivity in school children in Milan, Mich., has been associated with the roosting of starlings in trees on a playground (*25*).

In order to place the solved and unsolved epidemiologic problems presented by histoplasmosis in perspective and to evaluate the significance of the observations reported here, it is necessary to examine currently established facts about the distribution of *Histoplasma* and histoplasmosis. Many epidemiological features of histoplasmosis have been elucidated by surveys of hypersensitivity to histoplasmin (*26–28*), by studies of individual cases and of focal outbreaks of histoplasmosis (some of which are cited), and by isolations of *H. capsulatum* from saprophytic sources as reported and reviewed here. It is obvious that new epidemiological relationships have been discovered recently, and it is probable that other significant features remain unknown.

Certain erroneous concepts concerning histoplasmosis have persisted in the face of current evidence.

Despite the many reported isolations of *Histoplasma* (including its first isolation from and visible demonstration in soil) in the Maryland-Virginia area, two of the latest textbooks use a map (*29*) which gives no indication of the known high percentage (up to 83 percent) of histoplasmin reactors in communities of that region (*2*, *5*, *27*). Commenting on this map, Furcolow (*29*) states, ". . . the fungus does not grow in any great quantity—at least insofar as we know" east of the Appalachian Mountains. He speaks also of ". . . the absence of infection east of the Appalachians. . . ." But he adds, "It is true that in northern Virginia, and possibly in Maryland and Pennsylvania and certain other areas, there are foci of fairly high sensitivity."

This same report implies a relationship between "epidemics of histoplasmosis" and exposure to pigeon manure on upper floors of buildings, although the only reported isolations of *Histoplasma* associated with pigeon excreta have been in instances where soil was mixed with pigeon droppings, as was the case in the outbreak reported by Sabin (*30*). On the other hand, *C. neoformans*, which is known to cross react with *H. capsulatum* (*31*), is very frequently present in accumulations of pigeon manure in old nests and on upper floors of buildings (*6*, *7*).

In most instances urban isolations of *H. capsulatum* have been in villages or small towns, often with possible association with old chicken-houses, exposure to the former site of a chicken-house, or exposure to chicken manure used to fertilize gardens or flower beds (*32*). One urban outbreak (*23*, *24*) involved severe exposure to bird excreta on a large, neglected, wooded estate which was being cleared for a city park. The Washington, D.C., site described here is quite different from the Mexico, Mo., site (*23*, *24*), being without rural characteristics, even in miniature.

The specimens of soil reported in the present paper were taken from a well-kept small park adjacent to a busy street in a densely populated

downtown business section of Washington, D.C. The park had been periodically and recently cleaned, and there was no obvious contamination with bird excreta, although it is known that the soil under the sycamore trees where the collections were made is regularly contaminated with such material. It is obvious that roosting starlings can create a soil environment suitable for the growth of *H. capsulatum* even though bird excreta does not accumulate and remain on the surface of the soil. Studies will be continued by the collection of soil contaminated by starling excreta in this and similar urban areas.

Isolations of *H. capsulatum* from this typical urban environment demonstrate and define an urban type of human exposure to *Histoplasma* already suggested by others (*21–24*), and they reemphasize the well-known and adequately documented importance of histoplasmosis as a frequent disease and an important medical problem in Washington, D.C., and surrounding areas. The role of house bats (*9*) in producing urban habitats suitable for growth of *H. capsulatum* remains as a possibility not yet evaluated.

Summary

The recent isolation of *Histoplasma capsulatum* from soil in downtown Washington, D.C., justifies and requires a review of the frequency and importance of histoplasmosis in the Maryland-Virginia area. The importance of the Atlantic seaboard of the United States in the worldwide distribution of histoplasmosis has been ignored by some workers.

H. capsulatum was isolated from 10 of 10 soil specimens collected from a small, clean park adjacent to Pennsylvania Avenue NW., Washington, D.C., and from 1 of 5 specimens collected adjacent to another downtown Washington street. The first 10 isolations were from soil not obviously contaminated by bird droppings, but the soil specimens were taken under sycamore trees which are used as roosting places by a large flock of starlings (*Sturnus vulgaris*).

These isolations confirm, in a dramatic manner, the opinion expressed by others that roosting birds may play important roles in the epidemiology of urban histoplasmosis. They do not support the contention that pigeons are important in the maintenance of *H. capsulatum* in soil, although it has been well known since 1955 that virulent strains of *Cryptococcus neoformans* are commonly present in accumulations of pigeon droppings in both urban and rural areas.

REFERENCES

(*1*) Emmons, C. W.: Isolation of *Histoplasma capsulatum* from soil. Pub. Health Rep. 64: 892–896, July 15, 1949.

(*2*) Emmons, C. W., and Campbell, C. C.: Histoplasmosis in the District of Columbia, Maryland and Virginia. Clin. Proc. Children's Hosp. 13: 225–235, November 1957.

(*3*) McLeod, J. H., Emmons, C. W., Ross, S., and Burke, F. G.: Histoplasmosis. J. Pediat. 28: 275–295, March 1946.

(*4*) Emmons, C. W., et al.: Histoplasmosis: proved occurrence of inapparent infection in dogs, cats and other animals. Am. J. Hyg. 61: 40–44, January 1955.

(*5*) Olson, B. J., Bell, J. A., and Emmons, C. W.: Studies on histoplasmosis in a rural community. Am. J. Pub. Health 37: 441–449, April 1947.

(*6*) Emmons, C. W.: Isolation of *Cryptococcus neoformans* from soil. J. Bact. 62: 685–690, December 1951.

(*7*) Emmons, C. W.: Saprophytic sources of *Cryptococcus neoformans* associated with the pigeon (*Columba livia*). Am. J. Hyg. 62: 227–232, November 1955.

(*8*) Emmons, C. W.: Prevalence of *Cryptococcus neoformans* in pigeon habitats. Pub. Health Rep. 75: 362–364, April 1960.

(*9*) Emmons, C. W.: Association of bats with histoplasmosis. Pub. Health Rep. 73: 590–595, July 1958.

(*10*) Zeidberg, L. D., Ajello, L., Dillon, A., and Runyon, L. C.: Isolation of *Histoplasma capsulatum* from soil. Am. J. Pub. Health 42: 930–935, August 1952.

(*11*) Grayston, J. T., Loosli, C. G., and Alexander, E. R.: The isolation of *Histoplasma capsulatum* from soil in an unused silo. Science 114: 323–324, Sept. 28, 1951.

(*12*) Grayston, J. T., and Furcolow, M. L.: The occurrence of histoplasmosis in epidemics—epidemiological studies. Am. J. Pub. Health 43: 665–676, June 1953.

(*13*) Hazen, E. L., Little, G. N., and Mordaunt, V.: Isolation of *Histoplasma capsulatum* from two natural sources in the Mohawk Valley; one the probable point source of two cases of histoplasmosis. Am. J. Pub. Health 46: 880–885, July 1956.

(14) Hosty, T. S., et al.: A small outbreak of histoplasmosis. Am. Rev. Tuberc. 78: 576–582, October 1958.

(15) Lazarus, A. S., y Ajello, L.: Aislamiento de *Histoplasma capsulatum* del suelo de una cueva en el Peru. Rev. med. exper. Lima 9: 5–15 (1955).

(16) Campins, H., Zubillaga Z., C., Gómez López, L., y Dorante, M.: Estudio de una epidemia de histoplasmosis en el Estado Lara, Venezuela. Gac. méd. de Caracas 62: 85–109 (1955).

(17) Alarcón, D. G.: Histoplasmosis pulmonar epidemica. Gac. méd. Mexico 87: 745–750, Octubre 1957.

(18) Murray, J. F., et al.: Benign pulmonary histoplasmosis (cave disease) in South Africa. South African M. J. 31: 245–253, March 1957.

(19) Montemayor, L., Heredia Osio, B., y Bellard Pietri, E. P.: Aislamiento del *Histoplasma capsulatum* en el suelo de dos cavernas en Venezuela. Rev. san. y asis. social. 23: 39–54, Abril 1958.

(20) Gonzalez Ochoa, A.: Histoplasmosis primaria pulmonar aguda en la republica Mexicana. Rev. d. Inst. salub. y. enferm. trop. (Méx.) 19: 341–350, Diciembre 1959.

(21) Ajello, L: *Histoplasma capsulatum* soil studies. Mykosen. 3: 43–48 (1960).

(22) Aronson, D. L., and Edwards, P. Q.: An urban focus of histoplasmin sensitivity. Am. Rev. Tuberc. 79: 83–86, January 1959.

(23) Larsh, H. W.: Natural and experimental epidemiology of histoplasmosis. Ann. New York Acad. Sc. 89: 78–90, Aug. 27, 1960.

(24) The APHA conference report. Histoplasmosis epidemic attributed to starlings. Pub. Health Rep. 76: 150, February 1961.

(25) Whitehouse, W. M., Davey, W. N., Engelke, O. K., and Holt, J. F.: Roentgen findings in histoplasmin-positive school children. J. Michigan M. Soc. 58: 1266–1269 (1959).

(26) Christy, A., and Peterson, A. J.: Pulmonary calcification in negative reactors to tuberculin. Am. J. Pub. Health 35: 1131–1147 (1945).

(27) Palmer, C. E.: Geographic differences in sensitivity to histoplasmin among student nurses. Pub. Health Rep. 61: 475–487, Apr. 5, 1946.

(28) Edwards, L. B., Peeples, W. J., and Berger, A. G. Prevalence of sensitivity to tuberculin and histoplasmin among high school students in Montgomery County, Maryland. Pediatrics 21: 389–396, March 1958.

(29) Furcolow, M. L.: Recent studies on the epidemiology of histoplasmosis. Ann. New York Acad. Sc. 72: 127–164, Apr. 10, 1958.

(30) Sabin, A. B.: An epidemic of miliary granulomatous pneumonitis caused by *Histoplasma*. *In* Proceedings of the Conference on Histoplasmosis, 1952. PHS Publication No. 465 (Public Health Monogr. No. 39). Washington, D.C., U.S. Government Printing Office, 1956, pp. 20–23.

(31) Heller, S., McLean, R. A., Campbell, C. C., and Jones, I. H.: A case of coexistent nonmeningitic cryptococcosis and Boeck's sarcoid. Am. J. Med. 22: 986–994 (1957).

(32) Kier, J. H., Campbell, C. C., Ajello, L., and Sutliff, W. D.: Acute bronchopneumonic histoplasmosis following exposure to infected garden soil. J.A.M.A. 155: 1230–1232, July 31, 1954.

Directory of Parent Education Specialists

A directory of at least 500 persons professionally identified with the field of parent education through their work, position, title, special training, or publications is being compiled by Dr. Armin Grams of the Institute of Child Development of the University of Minnesota and Muriel Brown of the Children's Bureau. The Bureau expects to publish this "Directory of Specialists in Parent Education" in the fall of 1961.

An extensive list of names has been acquired, but the editors hope, if possible, to include all those eligible. Persons who wish to know more about the project are invited to write Dr. Armin Grams, Institute of Child Development, University of Minnesota, or Miss Muriel Brown, Division of Research, Children's Bureau, Department of Health, Education, and Welfare.

Participation in a Multiple Screening Clinic With Five-Year Followup

CHARLES M. WYLIE, M.D., Dr.P.H.

SCREENING TESTS are procedures that sort out persons who may have abnormalities from those who probably have none (*1*). Multiple screening is the simultaneous use of two or more screening tests. Its major aim is the early detection and treatment of disease. However, multiple screening may have no measurable effect on the screened population if most participants are free from undetected illness or are disinterested in seeking care for newly discovered disease, or if the disease found is one for which treatment is not beneficial. It is important to the success of screening, therefore, to know as much as possible about those who participate and those who decline to participate, and, if necessary, to develop better methods for attracting groups who will benefit most from screening.

Participation in some types of health programs has already been well studied. However, there is reason to believe that patterns of participation will not be the same for all preventive programs. Programs aimed at different diseases or involving different procedures may appeal to one population more than to another. For example, tuberculosis and poliomyelitis may be perceived in different ways by whites and nonwhites. Participation in programs aimed at eradicating each disease has differed with race, nonwhites being the more attracted to the chest X-ray programs. Participants in multiple screening, aimed at a variety of diseases, may differ from those attracted by single screening programs. Finally, even though it detects similar groups of diseases, multiple screening may attract different participants from those who are attracted by physical examination programs. Multiple screening is faster than physical examination and involves no undressing and no personal contact with a physician.

The purpose of this study is to contrast the characteristics of participants and nonparticipants in a multiple screening clinic, to describe their response to a questionnaire mailed in 1960, 5 years after screening was completed, and to compare change of residence figures. The study will also present mortality trends, causes of death, and morbidity figures for each group for the 5 years following screening.

Method of Study

To determine the prevalence of illness in Baltimore, the Commission on Chronic Illness, a national voluntary organization, studied a 1-in-80 sample of households, excluding institutionalized persons. This sample comprised 11,574 individuals. Interview data were obtained for 98 percent of these households. This study was begun in 1949 and completed in 1956.

Of this group, 6,967 individuals, aged 17 years and over, were reported free from serious health problems. The commission invited these persons to participate in a multiple screening clinic to be held October through December 1954. Efforts to persuade them to attend the

Dr. Wylie is assistant professor of public health administration, Johns Hopkins University School of Hygiene and Public Health, Baltimore, Md. Rose Mary Jacobs, Janet Hare, and Betty White contributed significantly to the study.

The study was financed in part by a grant from the National Institutes of Health, Public Health Service.

clinic included personal letters, telephone calls, home visits, and newspaper, radio, and television publicity. As a result 2,023 persons participated in the screening program (*2*). This was only 29 percent of those invited.

In 1960 the Johns Hopkins University School of Hygiene and Public Health obtained from the original records of the commission the sex, race, and age in 1954 of participants and of nonparticipants in the screening program. These records also provided the names, addresses, and telephone numbers in 1954 of all screenees. The same information was obtained on a one-in-five random sample of the nonparticipants. This sample corresponded closely in age, sex, and race distribution with all nonparticipants.

Four steps were taken to obtain more recent information on these individuals:

Step 1. We searched the latest city and suburban directories for Baltimore. These directories listed the names and addresses of residents for 1957 and 1958, respectively. We also searched the city and suburban telephone directories for 1959.

Step 2. We mailed a mimeographed letter to both screenees and nonparticipants, using the 1954 address when no new address was obtained in step 1. This letter reminded each individual of the screening clinic and asked his cooperation in returning a structured questionnaire composed of six items. A stamped addressed envelope was enclosed with the questionnaire. The letter and questionnaire differed in small details for screenees and for nonparticipants. To complete the questionnaire, each individual filled in his name, address, and telephone number.

Step 3. Persons who did not return the questionnaire within 2 months were contacted by telephone whenever possible. Thus, we were able to complete the majority of the questionnaires. The respondent was required to be the study member or a close relative.

Step 4. In the 1955–59 death certificate files for Baltimore and for the State of Maryland we searched for the names of all persons who had not been contacted previously. Deaths reported in returned questionnaires were also confirmed from these files.

Age, Sex, Race, and Socioeconomic Status

Table 1 shows that participation rates in the 1954 screening clinic were greatest in persons between 25 and 54 years of age. There was no consistent difference in attendance between white men and white women. In nonwhites below 65 years of age, however, participation rates were higher for women than for men.

Between the ages of 25 and 74, attendance was greater for whites than for nonwhites. In whites, the highest participation rate occurred between 35 and 44 years; above and below this range rates fell steadily. In nonwhites, the participation rate was fairly constant up to 54 years, and fell steadily above this age.

Screenees and nonparticipants thus differed

Table 1. Percentage of number invited attending screening clinic, by age, race, and sex

Age (years)	Both races (N=6,967) [1]	White			Nonwhite		
		Total (N=5,174)	Men (N=2,393)	Women (N=2,781)	Total (N=1,752)	Men (N=815)	Women (N=937)
All ages	29. 1	30. 2	30. 7	29. 8	24. 5	21. 6	26. 9
17–24	21. 7	20. 4	21. 8	19. 5	25. 1	22. 4	26. 9
25–34	30. 8	33. 2	29. 2	36. 9	24. 3	24. 2	24. 4
35–44	35. 0	38. 7	40. 3	37. 1	24. 2	20. 8	27. 4
45–54	29. 9	30. 7	29. 6	31. 9	25. 4	19. 9	31. 4
55–64	27. 6	28. 1	31. 7	25. 2	23. 9	18. 1	30. 3
65–74	23. 5	23. 2	22. 6	23. 7	21. 2	21. 6	20. 9
75 and over	12. 2	10. 8	14. 8	8. 7	16. 7	30. 0	7. 1

[1] Includes 41 persons of unknown age, sex, or race.

NOTE: N—number invited.

Table 2. Percentage distribution of 2,023 screenees and 4,944 nonparticipants, by age, sex, and race, 1954

Age, sex, and race	Screenees	Nonparticipants [1]
Age (years):		
17–24	11.0	16.1
25–34	25.0	22.9
35–44	27.5	20.9
45–54	18.5	17.7
55–64	11.5	12.3
65 and over	6.5	10.3
Sex:		
Male	45.6	46.4
Female	54.4	53.6
Race:		
White	77.6	73.2
Nonwhite	22.4	26.8

[1] Excludes those of unknown age.

in distribution by age and race, and only slightly by sex (table 2). The screenees included more persons between 25 and 54 years than did nonparticipants and fewer persons in the younger and older ages. The nonparticipants included the greater percentage of nonwhites.

Not shown in the tables is the fact that 12 percent of screenees and 27 percent of nonparticipants had no telephone, either in 1954 or 1959. This finding probably indicates the higher socioeconomic status of screenees.

Change of Residence

Our own address information was out of date and the post office redirected or returned more than 1,000 letters. Using the 1954 information modified by corrections obtained from the post office, returned questionnaires, and death certificate files, we placed each individual in one of four classes: (*a*) at same address as 1954; (*b*) moved, 1959 address known; (*c*) moved, 1959 address unknown; or (*d*) known dead. Table 3 summarizes these findings, and gives the definitions used for placing individuals in each class.

More screenees than nonparticipants remained at their 1954 addresses, or were at new, known addresses. Many more nonparticipants than screenees had moved to unknown addresses. These were believed to be mainly outside Baltimore; however, some may have moved so frequently within Baltimore that they were not listed in directories or post office files. Although not shown in table 3, for comparable age, sex, and race groups, significantly more nonparticipants than screenees had changed residence.

Questionnaire Return

Questionnaires returned without further contact with the addressee were classified as "spontaneously returned"; those filled in as a result of telephone followup were classified separately.

Table 4 shows the results of this classification. Many more screenees than nonparticipants spontaneously returned the questionnaire. About the same percentage in each group answered the questionnaire on telephone followup. Of those whose 1959 addresses were known, and who therefore were assumed to have received

Table 3. Residential status of screenees and nonparticipants on December 31, 1959

Residential status	Screenees		Nonparticipant sample	
	Number	Rate per 1,000	Number	Rate per 1,000
Total	2,023		1,021	
Same address as 1954 [1]	934	462	352	345
Moved:				
1959 address known [2]	768	380	288	282
1959 address unknown [3]	229	113	377	330
Known dead	92	45	44	43

[1] Questionnaire returned showing new address, or no questionnaire returned, but listed in directory at same address and not known dead.

[2] Questionnaire returned showing new address, or no questionnaire returned, but listed in directory at new address and not known dead.

[3] Questionnaire returned by post office stamped "Moved, no forwarding address," or no questionnaire returned and not listed in directory and not known dead.

the questionnaire, 59 percent of screenees and 27 percent of nonparticipants spontaneously responded. For comparable age, sex, and race groups, significantly more screenees than nonparticipants spontaneously returned the questionnaire. These data are not shown in table 4.

Death Information

The two sources of information on deaths were the returned questionnaires and the Baltimore and Maryland death certificate files. Without routine search of these files we would have missed 25 of the 92 known deaths in screenees and 17 of the 44 known deaths in nonparticipants. This task was therefore an essential step in the study.

Although the deaths are too few to give definitive findings, we have analyzed them further to obtain leads that may be helpful. Table 5 gives 5-year mortality figures for three age groups. In each group death rates for screenees were the same as or higher than death rates for nonparticipants in the 5 years following screening. However, more nonparticipants than screenees are believed to have moved away from Baltimore during this period. When death rates were adjusted for the greater emigration of nonparticipants, age-specific rates were about the same for screenees and nonparticipants.

To compare trends in mortality, table 6 presents the number of deaths and the percentage of all deaths occurring in each of the 5 years following completion of the study. The number of deaths in 1955, the first year after screening, was below average in both groups, followed by high figures for 1956. Both screenees and nonparticipants showed similar trends in deaths during the years 1957–59. If screenees had benefited greatly by their early referral for medical care, their subsequent death trends might well have been lower in the first year or two after screening. There was no evidence of a greater initial lowering of the death rates for screenees than for nonparticipants. We have no explanation for the greater number of deaths in 1956, which was an average year for the general population of Baltimore.

Table 4. Questionnaire returns by screenees and by sample of nonparticipants, for total group and for persons whose address was known, 1959

Study group	Number	Percent		
		Returned spontaneously	Completed by telephone	Not returned
Total group:				
Screenees	2,023	51.9	23.7	24.5
Nonparticipant sample	1,021	18.0	22.6	59.4
Known address:				
Screenees	1,794	58.5	26.7	14.8
Nonparticipant sample	864	26.9	33.8	39.3

Table 5. Mortality per 1,000 for screenees and nonparticipants, by age, 1955–59

Age (years)	Rate per 1,000			
	Unadjusted		Adjusted for movement from Baltimore [1]	
	Screenees	Nonparticipants	Screenees	Nonparticipants
All ages	45	43	49	53
Under 35	5	5	6	7
35–49	22	16	23	19
50 and over	133	119	149	147

[1] Based on assumption that persons not found in the study had moved from Baltimore at a uniform rate during the 5-year period 1955–59.

Table 6. Deaths among screenees and nonparticipants for each year following screening, 1955–59

Period	Number		Percent	
	Screenees	Nonparticipants	Screenees	Nonparticipants
1955–59	92	44	100.0	100.0
1955	15	6	16.3	13.6
1956	21	10	22.8	22.7
1957	18	8	19.6	18.2
1958	17	9	18.5	20.5
1959	21	11	22.8	25.0

Table 7 shows the causes of death in each group. More deaths in screenees than in nonparticipants were attributed to hypertensive disease, malignant neoplasms, and diseases of the digestive system. More nonparticipants than screenees died from nonhypertensive cardiovascular disease, central nervous system vascular lesions, and accidents. These differences are probably a reflection of the different age and race composition of the two groups and of the higher socioeconomic status of the screenees. The differences are not sufficient to suggest that multiple screening attracted a group with significantly more or significantly less of any particular disease than the nonparticipants.

Medical Care Habits

Persons who returned questionnaires are not likely to be representative of the total group to whom questionnaires were sent. However, when screenee respondents are compared with nonparticipant respondents, differences between the two respondent groups are likely to be in the same direction, though not of the same magnitude, as the differences between all screenees and all nonparticipants. For example, 37 percent of screenees and 31 percent of nonparticipants were aged 35–49 years; 38 percent of screenees and 35 percent of nonparticipants who returned questionnaires were also of this age. Fewer screenees than nonparticipants were 50 years old or older; the same held true for the respondents. Similarly, many more screenees than nonparticipants expressed interest in attending a second clinic; of those answering the questionnaire, 81 percent of screenees and 49 percent of nonparticipants stated that they would attend a second clinic. It therefore seems likely that large differences in medical care habits of screenees and nonparticipants would appear in the groups returning the questionnaire.

The questionnaire included two items asking the frequency of visits to a physician and the number of times the respondent was hospitalized during the period 1955–59. Table 8 presents the results of these questions. For all three age groups, more screenee than nonparticipant respondents visited their physicians twice or more per year. Although consistently suggesting that screenees consulted their physicians more often than nonparticipants, the differences were small. Again, more screenee than nonparticipant respondents were admitted to a hospital, for all reasons including childbirth, at least once during the 5-year period. However, the difference between screenees and nonparticipants for each age group was not consistently in the same direction; nonparticipants under 35 years of age were hospitalized more frequently mainly due to the higher childbirth rate among nonwhites. Considerably more screenees than nonparticipant respondents aged 35–49 years had been hospital inpatients.

Discussion

In this study, more screenees than nonparticipants were between 25 and 54 years old, were

Table 7. Causes of death in screenees and nonparticipants, 1955–59

Cause [1]	Number		Percent	
	Screenees	Nonparticipants	Screenees	Nonparticipants
All causes	92	44	100. 0	100. 0
Hypertensive disease (400–447)	13	3	14. 1	6. 8
Other cardiovascular disease (400–434, 450–468)	29	18	31. 5	40. 9
Malignant neoplasms (140–205)	19	5	20. 7	11. 4
CNS vascular lesions (330–334)	5	6	5. 4	13. 6
Accidents, poisonings, and violence (E-800–E-999)	3	6	3. 3	13. 6
Diseases of digestive system (530–587)	7	0	7. 6	. 0
Other	16	6	17. 4	13. 6

[1] International Statistical Classification numbers are given in parentheses.

Table 8. Frequency of physician visits and hospitalization, screenees and nonparticipants, by age, 1955–59

Age (years)	Number answering questionnaire		Percent visiting physician[1]				Percent hospitalized[2]			
			2 or more times		1 time or less		1 or more times		0 times	
	Screenees	Nonparticipants	Screenees	Nonparticipants	Screenees	Nonparticipants	Screenees	Nonparticipants	Screenees	Nonparticipants
All ages	1,423	384	47.1	44.8	52.9	55.2	35.5	32.4	64.5	67.6
Under 35	492	117	39.8	37.6	60.2	62.4	43.7	47.0	56.3	53.0
35–49	564	139	45.4	42.4	54.6	57.6	30.0	20.0	70.0	80.0
50 and over	367	128	59.4	53.9	40.6	46.1	33.0	32.5	67.0	67.5

[1] Per year.
[2] Per 5 years.

white, and were probably from a higher socioeconomic group. Participation rates for whites were about the same for each sex; in nonwhites under 65 years, women participated more than men. These findings differ from the findings on participation in a physical examination clinic in Baltimore, held at the same time and as part of the Commission on Chronic Illness study of prevalence of illness (*2*). In that study, participation in physical examination clinics was greatest in the youngest age groups and decreased with age. Participation rates were higher for males than for females and for nonwhites than for whites, the reverse of the findings in the multiple screening study.

Multiple screening and physical examination clinics comparable to those in Baltimore were held also in Hunterdon County, N.J. (*3*). As in Baltimore, peak participation in screening occurred in the middle age groups, while peak participation in the physical examination clinics occurred in the youngest group. In both Hunterdon County programs, females participated more than males, disagreeing with the sex findings of the Baltimore physical examination clinic. No race differences were mentioned in Hunterdon County.

Cobb and others (*4*) found that age and sex had little relation to participation rates in physical examinations carried out to determine the prevalence of arthritis in Pittsburgh, Pa. Unpublished data for the Framingham, Mass., cardiovascular study, in which physical examinations were offered to persons between 30 and 59 years of age in the study sample, showed that participation rates were highest in those below age 45, and fell above this age. In the Tecumseh, Mich., community health study currently in progress, preliminary unpublished figures showed peak participation in persons under 50 years of age, with lower rates in older groups; females participated slightly better than males.

In brief, the data on participation in multiple screening and physical examination programs show no uniform pattern for either program. There are indications, however, that each program may appeal to a different population group.

In our own study, more screenees than nonparticipants had remained at the same address or had moved to known addresses. Screenees were thus more easily reached by mail and telephone and were more stable in their residential habits. In followup studies of other programs for evaluating individual screening tests, screenees may be found relatively easily.

Screenees responded in significantly greater numbers to a mailed questionnaire than did nonparticipants in the program. Having attended the clinic in 1954, screenees would have a clearer picture of multiple screening procedures than nonparticipants and probably had a greater desire to help evaluate the clinic. Nevertheless, the difference in response was sufficiently great to suggest that participants in screening formed a group which was more cooperative in other respects, such as answer-

ing questionnaires, than were nonparticipants. The questionnaire and telephone followup for screenees was sufficiently complete to justify using these methods in future studies of screenees.

In the same age range, death rates were similar for screenees and nonparticipants. This finding differs from that in chest X-ray screening programs (*5*), which suggested that more nonparticipants than screenees had tuberculosis, with presumably higher death rates in nonparticipants. Moreover, in the Framingham epidemiological study of cardiovascular disease, preliminary figures showed that mortality in nonparticipants was twice as high as in participants (*6*).

Screenees and nonparticipants showed similar death trends for the 5 years following screening. This finding suggests that few screenee deaths were delayed by early detection of disease. In a paper still in preparation we will show that the Baltimore tests did indeed separate off groups with positive tests, whose subsequent death rates were much higher than the death rates for those with negative tests. The screening clinic may therefore have succeeded in bringing under medical supervision most persons with significant disease. If failure did occur, it may have occurred after screening when prompt medical care was not effective in reducing mortality. Preliminary unpublished figures from the Framingham study have shown that periodic physical examinations did not reduce annual death rates. However, mortality is an insensitive index of the effect of health programs, and participants may have benefited in other ways.

Finally, screenees who returned questionnaires had visited their physicians and were admitted to a hospital slightly more frequently than nonparticipant respondents. Though differences were small, it is probable that all screenees and nonparticipants differed in the same direction.

Summary

This paper has contrasted screenees and nonparticipants in the 1954 multiple screening clinic in Baltimore, conducted by the Commission on Chronic Illness. Screenees included more persons between 25 and 54 years of age and a higher percentage of whites, and were of a higher socioeconomic group than were nonparticipants. There was no sex difference among white screenees; among nonwhites more women than men participated in the clinic.

Screenees were the more stable in their residential habits. For the years 1955–59, more screenees than nonparticipants remained at the same address or moved to known addresses.

Significantly more screenees than nonparticipants answered a questionnaire mailed in 1960.

Screenees and nonparticipants had similar age-specific death rates and showed similar trends in deaths for each year following screening. The two groups differed in the proportion of deaths from various causes; this mainly reflected their different age, race, and socioeconomic composition.

The death trends provided no evidence that screenees benefited greatly by their early referral for medical care, nor did they suggest that multiple screening attracted a group with significantly more or less of any particular disease than the nonparticipants.

Finally, the questionnaire returns suggested, though not conclusively, that screenees visited their physicians and were admitted to a hospital more frequently than were nonparticipants.

REFERENCES

(*1*) Roberts, D. W., and Wylie, C. M.: Multiple screening in the Baltimore study of chronic illness. J.A.M.A. 161: 1442–1446, Aug. 11, 1956.

(*2*) Commission on Chronic Illness: Chronic illness in a large city. Cambridge, Mass., Harvard University Press, 1957.

(*3*) Trussell, R., and Ellinson, J.: Chronic illness in a rural area. Cambridge, Mass., Harvard University Press, 1959.

(*4*) Cobb, S., King, S., and Chen, E.: Differences between respondents and nonrespondents in a morbidity survey involving clinical examinations. J. Chronic Dis. 6: 95–100, August 1957.

(*5*) Hochbaum, G. H.: Public participation in medical screening programs, a socio-psychological study. PHS Pub. No. 572. Washington, D.C., U.S. Government Printing Office, 1958.

(*6*) Gordon, T., Moore, F. E., Shurtleff, D., and Dawber, T. R.: Methodologic problems in the long-term study of cardiovascular disease; observations on the Framingham study. J. Chronic Dis. 10: 186–206, September 1959.

Education Note

General Public Health Nursing Experience Of Nursing Students in a Specialized Agency

NICHOLAS J. FIUMARA, M.D., M.P.H.

In a previous article, Easter and I (*1*) described our experiences in providing field instruction in general public health nursing within the framework of a specialized venereal disease control program. Mention was made of the problems schools of nursing were having in placing their students for generalized field experience in public health because of the shortage of traditional facilities. It was apparent that some experimentation was necessary to determine whether agencies other than the usual ones could provide a satisfactory generalized educational experience.

In the summer of 1952, Easter investigated the possibility of using the facilities of the division of venereal diseases in the Massachusetts Department of Public Health and obtained firsthand information concerning the division's program, the qualifications of the supervisors and field personnel, and the type of experience a nursing student might expect to receive there. By working as a field nurse herself that summer, she became familiar with the basic pattern of the work of the venereal disease nurse epidemiologists. She perceived that these specialized nurses interested themselves not only in the possible presence of venereal disease but also in its impact on the patient and his family, that they were concerned with discovering why patients became sexually promiscuous, why extramarital exposures took place, and kindred matters, and that through skillful inquiry they became familiar with other medical, social, and emotional problems in the family, some of them totally unrelated to the disease itself.

In short, the venereal disease nurse epidemiologists practiced generalized public health nursing, using the specific problem of venereal disease as their mode of approach to the family. This is not surprising when one realizes that the epidemiologist has had generalized public health training and experience before she specializes.

The division of venereal diseases is charged with providing diagnostic and treatment care for those who have or suspect they have a venereal disease and are unable to afford private medical care. There are 23 State-cooperating venereal disease clinics scattered strategically throughout the State, 19 of them in the outpatient departments of general hospitals. In these clinics patients are examined and treated if infected. Here too the work of contact investigation begins with the all-important interview, which is conducted by a specialized public health nurse, called the nurse epidemiologist. The outcome of the contact investigation depends on these interviews. Working from a cooperating clinic, this nurse covers a specific area or district, and all patients and contacts residing therein are her responsibility.

Beginning in 1952, graduate nursing students

Dr. Fiumara is director of the division of venereal diseases, Massachusetts Department of Public Health. He is also on the faculty of the Boston University School of Medicine, Tufts University School of Medicine, and Harvard School of Public Health, and on the staff of the Massachusetts General Hospital, Massachusetts Memorial Hospital, Boston City Hospital, and Boston Dispensary.

were assigned to this division for 8 weeks and received the following instruction and experience:

1. Orientation on organization of the department of public health and the division of venereal diseases; the program of the division and how it is implemented; the division's relationship to other agencies. This is conducted by the medical director, the supervising public health nurses, and the senior clerical staff on the first day of the nurse's assignment to the division and occupies 1 full day.

2. A 6-hour lecture course on the clinical and public health aspects of the venereal diseases. The clinical lectures are given by the medical director, and the public health lectures, by one of the nursing supervisors.

3. Demonstrations by the division director and by clinic physicians of active cases of gonorrhea and syphilis in State-cooperating venereal disease clinics.

4. Observation during the first 2 weeks of the principles and practices of contact interviewing and investigation. The student is assigned to observe in several districts, each district representing a different phase of the program.

5. Assignment of the student as assistant to a public health field nurse for the remaining 6 weeks. She is given cases to work up, including contacts, suspects, and lapsed cases. At first, the field nurse accompanies the student. One or two weeks later the student is assigned to investigate cases by herself, but at the end of each day she reports to her field supervisor and discusses her cases with her. She also visits patients accompanied by the supervisor, who observes the following:

- Does the student establish rapport easily?
- Is the student aware of other problems the patient may have?
- What is the impact of this disease on the patient?
- What is the impact of this disease on the family?
- Are there any problems of the family which directly or indirectly contributed to the development of venereal disease or sexual promiscuity; for example, divorce, separation, desertion, maladjusted marriage, illegitimacy, unfavorable environment?
- Are there other problems in the family not related to venereal disease? These may be medical, social, economic, moral, or environmental.
- Is the patient pregnant? If so, does the student inquire about prenatal care?
- Is the student aware of other agencies, and does she refer problems to them?
- Is she an effective teacher?

The system of instruction used by the division of venereal diseases has several advantages. First, one qualified field instructor is assigned to each student. Second, the student is prepared for the actual "doing" experience by didactic and observational teaching. Third, there is an adequate caseload and a sufficiently varied group of patients for the students to gain a wide experience.

At the request of a number of interested nursing educators, a method was devised to determine the kind and amount of experience these nursing students received during their 8-week training period. These records have been tabulated for the fiscal year 1958–59, and the results are presented in this report.

Method of Study

Each nursing student beginning her field experience after 2 weeks' orientation and observation was requested to fill out a study form on all patients and suspects who were assigned to her for field visits and who were found by her. If she did not locate the individual, obviously no form could be completed. In addition to the name, address, age, sex, color, and marital status of the patient, the form asked whether the nursing student had discovered any medical or social condition other than the venereal disease in her patient or her patient's family, what were the conditions, whether the case was already under medical or social care, and if not, how the problem was handled. These study forms were shown each day to the field supervisor, who discussed the case with the student and when necessary took appropriate corrective or supplemental action. The forms were accumulated for 1 week, and on the Monday of the succeeding week, the field supervisor sent the completed forms and the student's summary of her week's experience to the central office.

It is important to emphasize that study forms

General public health nursing problems elicited by student nurses receiving field instruction in venereal disease agency, fiscal year 1958–59

Type of problem	Number of cases	Percent of total	Percent of total with problems [1]
New venereal disease suspect	6	1. 6	2. 1
Arthritis	7	1. 8	2. 4
Cancer	0	0. 0	0. 0
Cardiovascular	8	2. 0	2. 8
Diabetes	6	1. 6	2. 1
Other noncommunicable diseases	70	18. 0	24. 4
Tuberculosis	6	1. 6	2. 1
Other communicable diseases	33	8. 5	11. 5
Prenatal	30	7. 7	10. 5
Postpartum	6	1. 6	2. 1
Alcoholism	29	7. 5	10. 1
Mental health	44	11. 3	15. 3
Other	42	10. 8	14. 6
No problems	101	26. 0	
Total	388	100. 0	100. 0

[1] 287 cases.

were completed on all patients, suspects, and contacts who were actually found, and the observations recorded are those of the student prior to her conference with the field supervisor.

Analysis of Reports

From October 1958 through May 1959, eight graduate nursing students received the 8 weeks of field training in the division of venereal diseases. These students found 388 patients on whom study forms were completed (see table), and they detected a medical or social problem other than known or suspected venereal disease in 287 patients, or 74 percent. Considering the fact that this was their first actual exposure to public health nursing experience, it was gratifying to learn that they were able to detect problems other than venereal disease in such a high percentage of patients.

Of the 287 patients, 2 percent were venereal disease suspects who were household members not previously uncovered through contact interview at the clinic. Approximately 2½ percent of the patients had arthritis, none had cancer, almost 3 percent had cardiovascular disease, 2 percent had diabetes, and 24 percent had some other noncommunicable disease such as cataract, laceration, fracture, anemia, or hernia.

Tuberculosis was discovered in 2 percent, and 11½ percent of the patients had some other communicable disease, such as pneumonia, scarlet fever, chicken pox, paralysis as a result of poliomyelitis, middle ear infection, infectious diarrhea, and purulent conjunctivitis.

Pregnancy was found in 10½ percent of the group, and 2 percent were referred to a hospital for postpartum care. Alcoholism was discovered in 10 percent, and, interestingly enough, 15 percent had mental health problems, of which anxiety syndrome was the most common. Another 15 percent had problems not covered in the specified categories and mostly social in nature, such as desertion on the part of a spouse and illegitimacy without financial resources.

Summary

A quantitative report is presented of the types of generalized public health nursing experience of graduate nursing students in a specialized agency, the division of venereal diseases of the Massachusetts Department of Public Health. These nursing students were able to detect a medical or social problem other than known or suspected venereal disease in 74 percent of their patients.

REFERENCE

(1) Easter, E. M., and Fiumara, N. J.: A specialized agency for field instruction in public health. Pub. Health Rep. 72: 217–222, March 1957.

Toward Solving the Accident Problem

KENNETH I. E. MACLEOD, M.B., Ch.B., M.P.H.

ACCIDENTS as a cause of death and disability are of universal concern. Therefore, with the thought that in an aging city environment with much deteriorating property and overcrowded neighborhoods, the accident rate might be higher than would be expected by chance, I visited such a neighborhood, at the invitation of a sanitarian. Here I saw occupied dwellings in such bad condition that I immediately obtained the sanction of the Worcester Department of Public Health to condemn them as "unfit for human habitation" under a State law passed in 1954. This was the beginning of an intensive drive against substandard housing in Worcester.

Believing that the number of accidents under substandard housing conditions might be large, I decided to measure the size of the accident problem in the entire city. An accident survey committee was set up, and I sought financial assistance and backing from various outside agencies. Although I failed to obtain such assistance, I decided to proceed with the survey. This meant that the six general hospitals in the city would participate in the study without additional clerical assistance and that the health department would give time and labor as part of its normal routine. The Worcester County Safety Council agreed to underwrite the relatively modest cost of materials.

The survey was carried out over the 12-month period July 1, 1957–June 30, 1958.

The Survey Plan

The plan of the survey was simple. It seemed most practical to collect and tabulate only accident reports from the six general hospitals in the city. Information requested on report cards was brief and to the point. Cards of a different color were used by each hospital. At the outset of the survey, two orientation meetings were held with the hospital clerks, and I kept in touch with them periodically thereafter.

Findings

Of the total of 20,077 accident reports received during the survey year, 19,752 were usable for tabulation purposes. A seasonal incidence of accidents was noted, with a marked peaking in the summer months (fig. 1). For most age groups, this rise was coincident with increased outdoor and vacation activities. For the group aged 15–19 years, however, the highest incidence of accidents was in October, when 165 youths were injured playing football.

The average daily number of accidental injuries reported was 53.8 (fig. 1). The highest daily average, 71.2, was in July; the lowest, 41.3, in March. February had the smallest number of accidents.

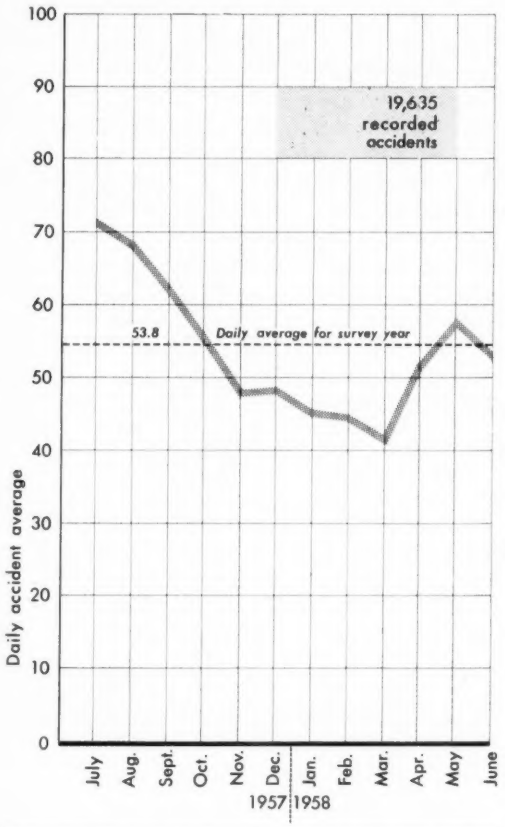
Types of Accidents

Traffic accidents reached a peak in December, closely followed by lower peaks in July

Dr. Macleod is health commissioner, Cincinnati Health Department, Cincinnati, Ohio. At the time of this study he was commissioner of public health, Worcester Department of Public Health, Worcester, Mass.

This paper is an abridged report of the Worcester Accident Survey, carried out July 1, 1957–June 30, 1958. The Accident Prevention Branch of the Public Health Service assisted in setting up tabulations of the study data.

Figure 1. Incidence of accidents, by month, Worcester Accident Survey, Worcester, Mass., 1957–58



1957			1958		
Month	Total accidents	Daily average	Month	Total accidents	Daily average
July	2,207	71.2	January	1,395	45.0
August	2,110	68.1	February	1,248	44.6
September	1,863	62.1	March	1,281	41.3
October	1,702	54.9	April	1,523	50.8
November	1,435	47.8	May	1,778	57.4
December	1,490	48.1	June	1,603	53.4

and August. Injuries resulting from falls from one level to another were most frequent in July and August. On the other hand, the number of falls on the same level was highest in January. The highest accident rate for athletic activities and sports was in October, which had the largest number of football accidents of any month in the year.

The percentages for 17 types of accidents exceeded 1 percent of the total accidents reported, but 5 types led the list. These were:

	Percent
Falls on the same level	18.6
Falls from one level to another	10.8
Motor vehicle	10.4
Cutting or piercing instrument	9.8
Blow from falling or projecting object	7.7

Each age group had a distinctive accident pattern. Falls on the same level were the principal cause of injury at all ages except 15–19 years, when motor vehicle accidents and participation in sports were the leading causes. Motor vehicle accidents were the first cause of injury in the 20- to 24-year age group also. From age 70 onward, falls accounted for more than half of all accidental injuries. In early childhood, burns, poisonings, and animal bites were frequent causes of injury.

Injury Rates

The following accidental injury rates per 1,000 population, by age groups, were obtained from the 1958 State estimates of population:

	Injury rate
All ages	72.3
Under 5	121.0
5–19	118.1
20–64	54.7
65 and over	31.0

Table 1. Accidental injuries per 1,000 population,[1] by age and sex, Worcester Accident Survey, Worcester, Mass., July 1, 1957–June 30, 1958

Age (years)	Both sexes	Males	Females
All ages	72.3	99.4	48.0
Under 1	34.8	36.7	32.8
1–4	139.8	175.2	106.9
5–9	115.7	161.5	73.6
10–14	124.0	180.6	69.6
15–19	114.7	180.6	58.1
20–24	81.3	124.6	41.8
25–29	65.9	96.9	36.6
30–34	61.7	90.7	33.4
35–39	60.8	90.4	35.3
40–44	52.7	69.2	38.1
45–49	53.3	70.8	38.2
50–54	43.7	50.0	38.5
55–59	39.0	45.1	34.0
60–64	31.3	35.5	27.7
65–69	28.6	31.4	26.2
70 and over	32.7	27.3	37.2

[1] 1955 State estimate.

Preschool children had the highest percentage of injuries, 15.5 percent. Injury rates per 1,000 population, by age and sex, are shown in table 1.

More than half the accidental injuries reported were in persons under 20 years of age; over 40 percent, in persons under 15 years old. The 1- to 4-year age group had the highest accident frequency. In each age group over 1 and under 70 years, the frequency of accidents in males exceeded that in females, in some age groups by nearly three to one (table 1).

Activity at Time of Accident

The order of frequency of accidental injuries, by place of activity, was as follows:

Place of activity	*Percent of accidents*
Home	43.5
Street or highway	15.8
Industrial place or premises	9.6
Place of recreation or sport	4.9
Public building	3.4
Other specified place	1.4
Unknown or not stated	21.4

The three leading activities at the time of occurrence of the 8,604 known home accidents were: sports, recreation, or entertainment, 2,969; ascending or descending stairs, ladders, and so on, 808; and housekeeping, 506. In the complete report of the survey, the other categories have been similarly differentiated.

Activities at the time of the accident were listed in 10 broad categories, each containing many subcategories. Thus, the category "operating or riding in or on a vehicle" included a subcategory entitled "operating an automobile." In the category "participating in sports, recreation, and entertainment" there were 35 subcategories, from "playing baseball or softball" to "riding at an amusement park" and "spectator, (sports, TV, movie, fire, construction, and so on)." The numbers of injured in each major category excluding those in categories for which no activity was indicated are shown in table 2.

Through age 14 playing, manner unspecified, was the principal activity leading to injury; at all ages through 19 years, play activities, whether specified or not; and for ages 20–84 years, work activities were among the 10 leading causes of injury.

The 19,752 accidental injuries reported in the survey were distributed among 999 selected categories of activities. Thirty-five of these categories included 100 or more persons each. The 12,196 cases listed in these 35 categories were 61.8 percent of the total 19,752 accidents reported.

For the entire population of Worcester, 1 of 10 activities caused approximately 65 percent of all reported accidental injuries to children under 9 years of age, about 45 percent of injuries to persons 10–84 years old, and about 80 percent of those in persons aged over 85 years. These leading injury-producing activities, in descending order of frequency, were:

	Number
Playing, unspecified	2,199
Working, unspecified	1,296
Walking, unspecified	898
Playing in the house, unspecified	702
Passenger in automobile	664
Descending stairs	605
Operating automobile	455
Running	400
Walking in house	399
Riding bicycle	370

Home Accidents

A total of 8,604 home accidents were reported in the survey. The highest total for any month was 989, for August 1957, and the lowest 470, for February 1958.

The play activities of childhood were the most common cause of home accidents for both

Table 2. Number and percent of persons injured, by activity at time of accident, Worcester Accident Survey, July 1, 1957–June 30, 1958

Activity	Number	Percent
Operating or riding in or on a vehicle	2,198	11.1
Participating in sports, recreation, and entertainment	5,232	26.3
Maintaining, repairing, constructing, and so on	1,679	8.4
Ascending or descending (stairs, ladders, and so on)	1,118	5.6
Handling materials or objects	905	4.5
Housekeeping	669	3.4
Preparing, serving, or consuming food	535	2.7
Caring for or grooming self	208	1.0
Farming or gardening	69	.3
All other activities	5,563	28.1

sexes. The next three activities leading to accidents were "ascending or descending," "preparing or consuming food," and "caring for or grooming self." But surprisingly, "operating or riding in or on a vehicle" was reported as a home accident for certain age groups. These accidents presumably took place on the home premises.

Through 24 years of age males predominated as the victims of home accidents of all types. But from age 25 on to old age, females predominated, markedly so in old age, reflecting the high ratio of women to men who survive to old age. For women aged 25–74 years, housekeeping and related activities were the leading activities at the time of an accident.

By location, home accidents within or outside the home showed a seasonal variation, with the highest incidence in the summer months. The porch, for example, was the scene of many accidents in the summer months.

The most common accident locations, in order of frequency, were: yard, 2,582; kitchen, 1,402, and stairs, 608. In descending order of frequency, locations with an accident incidence in excess of 100 persons during the survey year were the stairs, bedroom, living room, basement, porch, other rooms in the house, and the steps.

Certain locations showed a sex differential for accidents. Outdoors and in the basement males predominated as the injured, whereas indoors, females were injured at approximately the same rate as males, or more often, depending on the location. Among children, males consistently predominated as the injured. Indoors, after 18 years of age, females were injured more frequently than males, in certain locations markedly so. This was particularly true of the kitchen and the stairs.

Falls accounted for nearly 40 percent of the injuries sustained at home, 1,844 occurring on the same level and 1,465 as a result of falling from one level to another. The 966 injuries from cutting or piercing instruments ranked second, and blows from falling or projecting objects, third. Among the other types of accidental injuries reported were 290 accidents due to poisoning by solid or liquid substances. The majority of these accidents affected preschool children. Two deaths from accidental poisoning were reported, one of an adult and one of a child who died shortly after swallowing her mother's nitroglycerin heart pills.

Occupation

Among males whose occupation was recorded, operatives and kindred workers suffered the highest number of accidental injuries, with craftsmen, foremen, and so on, second, laborers third, and service workers fourth. For females, service workers led as the victims of accidental injuries followed by clerical workers, operatives, and professional workers, in that order. For professional workers, the accident rate per 1,000 population was 61.1 for females and 49.8 for males. The higher rate for females was noteworthy, since the accident rate for males is higher than the rate for females in each of the other occupational groups.

Because the most recent population data available were from the 1950 census, it was felt that injury rates for detailed occupations, including sex differentials, based on census figures would be unreliable. Therefore, accident rates were calculated for each major occupational group, as follows:

Occupational group	*Rate per 1,000*
Nonlabor force	79.8
Labor force	60.4
Professional, technical, and kindred workers	38.8
Managers, officials, and proprietors	28.9
Clerical and kindred workers	38.1
Sales workers	33.1
Craftsmen, foremen, and kindred workers	76.8
Operatives and kindred workers	63.7
Private household and service workers	79.0
Laborers, except farm and mine	163.0

Severity of Injury

The severity of the injuries received was considered to be a measure of the risk to the accident victim's life, but on many reports the information on this point was insufficient for interpretation. The following data are based on reports of 7,789 nonfatal accidents for which the severity of injury was shown.

Severity of injury	*Number*	*Percent*
Minor	6,015	77.2
Moderate	1,475	18.9
Severe	299	3.8

For two specified types of accidents, the severity of injury was as follows:

	Motor vehicle and traffic (percent)	*Cutting and piercing instruments (percent)*
Minor	64.4	91.1
Moderate	25.7	8.0
Severe	9.9	.8

Admission of the victim to a hospital can safely be assumed to imply that an accident is severe. Some 1,777 of the total individuals in the accident survey were hospitalized. A study of severity of injury in both outpatients and inpatients indicates that the proportion of accidents that could be rated as severe, or very severe, was distinctly higher, 108 (6 percent) in the inpatient group. Incidentally, 10 of the 32 persons fatally injured were listed as outpatients, 18 as inpatients, and the hospitalization status of 4 was not stated. Motor vehicle accidents, falls, and blows generally accounted for the more serious injuries.

Part of Body Injured

The hand, including the fingers, was the part of the body most commonly injured. For ease of analysis, the parts of the body sustaining the primary injury have been grouped into broad categories, as follows:

	Percent
Upper extremity	35.5
Head	28.6
Lower extremity	22.3
Trunk	7.8
Shoulder	2.5
Hip	1.1
Generalized	1.8
Other	.4

In computing these percentages, 691 injuries for which the injured part was unknown or not stated were excluded.

Nature of Primary Injury

In the group under 1 year old, contusions, hematomas, lacerations, and avulsions were the most frequent types of injury. Lacerations led in frequency in every age group from 1 to 70 years. From age 70 on, fractures led, largely because of their high frequency in elderly females. From age 55 on, fractures were more common among females than among males, and from age 60 on they were the most common cause of injury among females.

Poisoning was the third most frequent cause of accidental injury in the age group 1–4 years but was negligible in the group under 1 year. Burns and scalds were also a common cause of injury in preschool age groups. Fractures and puncture wounds were important primary injuries in school-age children. Until the later years of life, lacerations, sprains, and contusions were the most frequent causes in all age groups until fractures took first place among the elderly.

Fatalities

Not all of the residents of Worcester who died from accidents were treated at one of the six hospitals participating in the survey. Also, the deaths of some patients who died as a result of a complication, such as bronchopneumonia, may not have been reported as deaths due to accident. For example, the death of an elderly man or woman hospitalized because of a fracture of the hip due to a fall but who died as a result of a complication may not have been reported as a death due to an accident. Therefore, only 32 deaths were reported to the survey as being the result of an accident.

Two additional sources of reports of accidental death were searched, newspapers serving the Worcester area and returns from the city clerk's office. In Massachusetts vital statistics are the responsibility of the secretary of State and are recorded locally by municipal clerks. These statistics include all known accidental deaths of residents of Worcester, whether the accidents took place within or outside the city limits. They also include the deaths of nonresidents who were treated at one of the participating hospitals or who died as the result of accidents occurring within the city limits. Tables 3 and 4 categorize the 104 accidental deaths of residents and nonresidents reported during the survey period.

Of the 104 persons who died from accidents, 71, or 68.2 percent, were residents of Worcester and 33 were nonresidents. Of the 71 residents, 18 were injured outside the city limits. Of the 33 nonresidents, 11 were injured within the city

limits. A large number of deaths of elderly persons were consequent upon falls, with or without further complications. Most of the deaths occurred at home, 11 in Worcester area rest homes, nursing homes, or hospitals. One person died from a fall from a treatment table.

Forty Worcester residents died from accidents occurring in their homes. Fires accounted for six deaths. There were six drownings. One boy drowned in his bath at home, four were drowned at locations outside the city, and one victim was struck by a speed boat. Two "on the job" accidents resulting in death occurred within the city limits. Among the deaths from miscellaneous causes, two resulted from plane crashes, one of which took place within the city limits.

In three fatalities, lacerations and avulsions were the dominant injuries; in three, concussion; in two, hemorrhage. But hip fracture and some other fracture or fractures in 38 elderly persons were the noteworthy leading primary injuries. Burns, various injuries, and asphyxia as the result of fires affected seven victims of home accidents.

In street and traffic accidents, two elderly pedestrians died after falls, one with a subdural hematoma, the other with a fractured left hip. Fractures of the skull with brain injuries or other head injuries were the primary injuries in 10 street and traffic deaths, but in many of them there were also other severe injuries, including other fractures and hemorrhage. But in some cases, reports of the injuries were not detailed; only phrases such as "multiple fracture or injuries" were given. Rib fractures, crushing injuries of the chest, leg fractures, broken neck, and skull fractures, and ruptured spleen, kidney, or liver with complicating hemorrhage were also listed as primary injuries. Fracture of the pelvis was listed in two instances but in 14 of 36 "traffic" cases no details were available of the injuries received that caused death.

Table 3. Fatalities reported by six participating hospitals and by other sources, according to accident category, age, sex, and place of residence, Worcester Accident Survey, Worcester, Mass., July 1, 1957–June 30, 1958

Accident category and age (years)	Total	Sex		Residence	
		Male	Female	Resident	Nonresident
All accidents	104	70	34	71	33
0–4	8	7	1	5	3
5–19	12	10	2	3	9
20–64	38	32	6	30	8
65 and over	46	21	25	33	13
Home	51	24	27	39	12
0–4	6	5	1	4	2
5–19	0	0	0	0	0
20–64	9	6	3	8	1
65 and over	36	13	23	27	9
Traffic and street	35	29	6	18	17
0–4	2	2	0	1	1
5–19	9	8	1	1	8
20–64	16	13	3	12	4
65 and over	8	6	2	4	4
Work [1]	3	3	0	1	2
0–4	0	0	0	0	0
5–19	0	0	0	0	0
20–64	2	2	0	0	2
65 and over	1	1	0	1	0
Miscellaneous	15	14	1	13	2
0–4	0	0	0	0	0
5–19	3	2	1	2	1
20–64	11	11	0	10	1
65 plus	1	1	0	1	0

[1] On the job.

Table 4. Fatalities reported by six participating hospitals and by other sources, according to accident category, place of death, and residence, Worcester Accident Survey, Worcester, Mass., July 1, 1957–June 30, 1958

Accident category and place of death	Total	Resident	Nonresident
All categories	104	71	33
In city	64	53	11
Outside city	40	18	22
Home	51	40	11
In city	42	39	3
Outside city	9	1	8
Traffic and street	36	18	18
In city	14	9	5
Outside city	22	9	13
Work [1]	3	1	2
In city	2	1	1
Outside city	1	0	1
Miscellaneous	14	12	2
In city	6	4	2
Outside city	8	8	0

[1] On the job.

The primary injuries in the three "work" accidental deaths included fracture of the spine after a 70-foot fall, epidural hematoma after being struck on the head by a lump of ice, and the long-term result of the inhalation of metal dust.

Among the miscellaneous deaths, chest injuries with hemorrhage, skull and head injuries, drownings, accidental shooting, and other such injuries occurred.

Others Involved in the Accident

The data in response to the question, "Were others involved?" were unreliable, due to various interpretations of the question. On the other hand, answers to the question, "Were others injured?" could be interpreted with some accuracy. But in view of the large number of nonresponses, 16,813 out of 19,752, any conclusions must be carefully stated. However, according to results of this survey, 3,243 persons other than the principal accident victims were involved in the accidents in some way, and 1,993 of them were reported as being injured in motor vehicle accidents.

Census Tracts

An attempt was made to study the accident rate and type of accident in Worcester, by census tract, using the 1955 estimated State census as the population base.

Table 6. Number[1] of accident victims in selected census tracts, by age group, Worcester Accident Survey, Worcester, Mass., July 1, 1957–June 30, 1958

Census tract No.	Age group (years)			
	0–4	5–19	20–64	65 and over
All Worcester	4, 668	4, 940	4, 627	836
1	68	119	59	24
4	45	145	136	18
9	120	125	108	33
13	91	232	252	33
17	29	73	267	57
20	215	259	198	15

[1] Less "not stated" in table 5.

Census tract 13, in the center of the city, and census tract 20, in the outskirts showed a strikingly high incidence of accidental injuries, 10.1 and 10.4 percent, respectively (table 5). About 50 percent of the accident victims in census tract 20 were preschool children (table 6).

The high accident rate in census tract 20 was at first difficult to explain, in view of the generally excellent supervision of large public housing projects by the municipal housing authority. However, since most of the project dwellers have low incomes, they are likely to use the outpatient facilities of a hospital for

Table 5. Number and percent of accident victims and of home accidents reported by six hospitals, according to selected census tracts, Worcester Accident Survey, Worcester, Mass., July 1, 1957–June 30, 1958

Census tract No.	Population	Accident victims								Home accidents	
		Total		Outpatients		Inpatients		Not stated			
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All Worcester	202, 612	15, 332	7. 50	13, 822	6. 8	1, 249	0. 61	261	0. 12	6, 780	3. 31
1	4, 360	270	6. 19	251	5. 75	19	0. 43	0	0	140	3. 21
4	4, 571	347	7. 59	317	6. 93	30	. 65	5	. 10	181	3. 95
9	7, 199	386	5. 30	349	4. 84	33	. 45	4	. 05	190	2. 63
13	6, 095	617	10. 10	546	8. 95	61	1. 00	10	. 16	251	4. 11
17	5, 967	435	7. 29	350	5. 86	77	1. 29	8	. 13	132	2. 21
20	6, 722	699	10. 40	653	9. 71	39	. 58	7	. 10	410	6. 09
23	8, 107	580	7. 15	543	6. 69	32	. 39	5	. 06	262	3. 23

Census tract 13, Worcester, Mass.

Neighborhood with no sidewalks, poor roadway, crowded dwellings

Large industry, parking lot not in full use, parking on roadway excessive

Main street—apartments and business area

the treatment of their children rather than to call a physician or to visit his office.

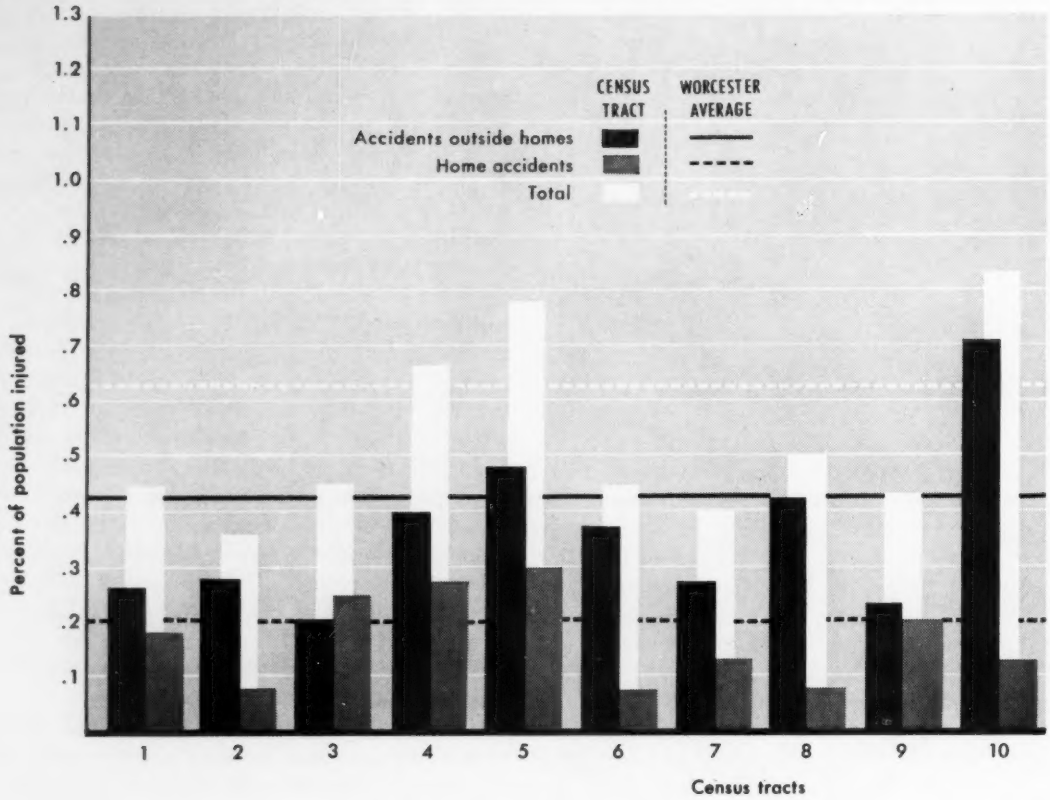
For this reason, the pattern of accident incidence for all census tracts was examined for inpatients only, on the theory that the more seriously injured, whether originally treated by a physician at his home or in his office or in the outpatient department of a hospital, would be admitted to the hospital for further treatment and care. When the charts of inpatients were examined, it was found that census tract 17, which is in the center of the city, adjacent to tract 13, had the greatest accident incidence. Of the inhabitants in this census tract, 1.29 percent were admitted to hospitals for injury during the study year, compared with 0.62 percent for Worcester as a whole. Figure 2 gives accident data for inpatients from census tracts 1–20 and an average for the city, broken down by total accidents, home accidents, and accidents outside the home. Census tract 21 is comprised of Worcester State hospital. In census tracts 22–31, the total accidents were fewer than the average for the entire city; in tracts 28–31, home accidents were slightly above the average.

Census tract 13, population 6,095, is made up of multifamily dwellings, large areas are occupied by industry, and business establishments front on the main street (see photographs). The only play area is University Park, at the extreme end of the tract. This tract had the second highest rate for all accidents and the second highest rate, 1.0 percent, for accidents to hospital inpatients. The rate for home accidents resulting in admission to the hospital was the highest observed.

Four students from a local college made a survey of census tract 13 as a study project, using a rough sampling method and a questionnaire. For comparison, census tract 4, a small tract with a relatively low accident rate, was also studied. This tract is an expanding residential area, with mainly single-family dwellings in the northern half and multifamily dwellings in the southern half, and with large areas used for business offices, parks, and schools. Its population is 4,571. In this tract, the inpatient accident rate was the lowest in the city, 0.27 percent.

This substudy of census tract 4 strongly sug-

Figure 2. Percentage of accidents in 1955 population, by census tracts,



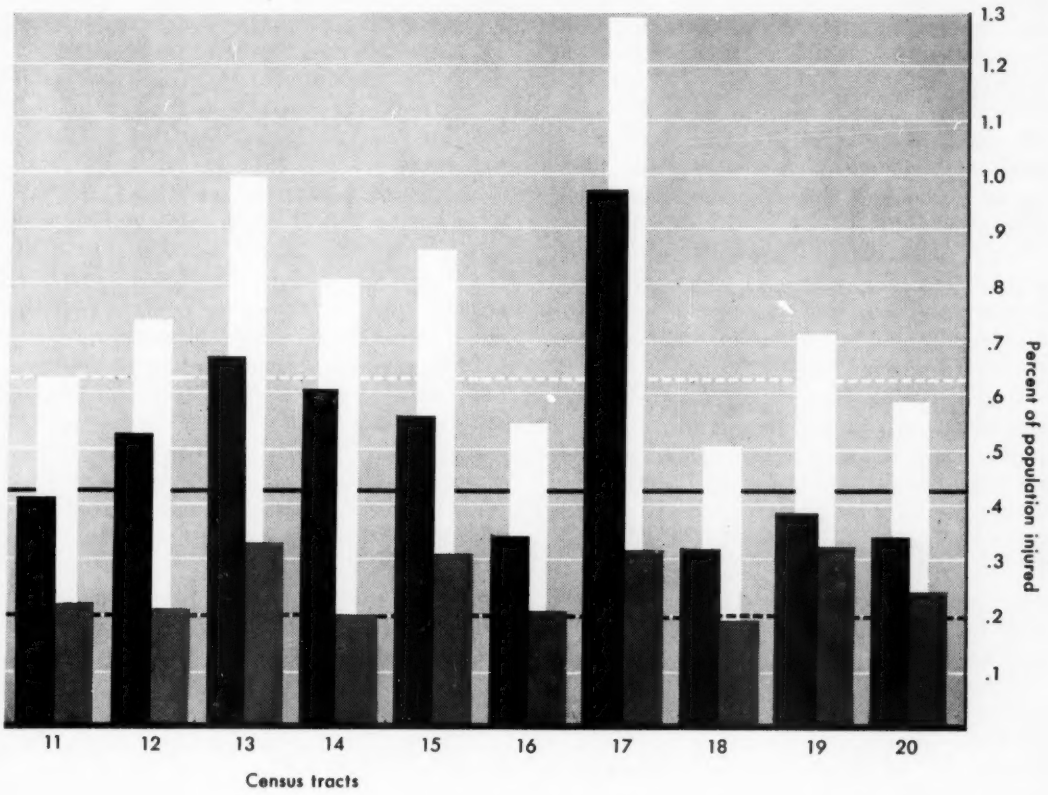
gests that there is a real and possibly significant connection between the deteriorating, overcrowded conditions in census tract 13 and its high incidence of accidents, both in the home and in other places, when compared with census tract 4, with its relatively low accident incidence.

Discussion

Accidents, at least in the United States, "rank above disease as the chief cause of death and disability to many segments of the population and cause a major threat to the well-being and health of the people" (*1*). Public health, with its approach to problem solving, should have a most significant role to play in accident prevention. The same public health techniques can be applied to accident prevention as to other health problems. Much research in the field is going on in various centers and under various sponsorships (*2–9*), but there are still many gaps in our knowledge. For example, how accurate is our information on the extensiveness of the overall accident problem?

The finding of over 20,000 hospital-treated accident cases in the Worcester area indicates that the problem is indeed an extensive one. This figure of course takes no account of the accident cases treated by a physician in his office or of those either treated at home by a physician or by a member of the victim's household without professional help. Although a great majority of accidents result in only minor injuries, every accident is potentially serious. Therefore, there is need for further research into the problem, both in toto and segmentally. The comparative severity of accidents and the number of fatalities from accidents have been discussed (*10–18*). The measure of the severity of injury was the degree of danger to the

inpatients of six hospitals, Worcester Accident Survey, Worcester, Mass., 1957–58



life of the victim, not the degree of severity of the injury per se. A badly crushed hand might be a severe injury, yet danger to life might be negligible.

Results of injuries sustained in accidents vary in relation to the age of the victim. There are many factors—physical, environmental, and psychological—to be taken into account (*5–7, 17,18*). For example, football, which results in the greatest number of accidental injuries, some of them serious, among youths, should always be played under strict supervision and control, and players should wear appropriate protective equipment. In Worcester, since the termination of the accident survey, backyard football has resulted in one death: a boy was injured on the head. He was not wearing any protective gear and he had no supervision.

Accidents affect proportionately more or fewer individuals at various age levels. In childhood, accidents, are the leading cause of death in the Nation. But after 34 years of age, they rank second, third, fourth, or fifth in each 10-year age group (*11*).

Worcester had a fairly adequate traffic enforcement program, resulting in an improved accident experience. On-the-job accidents are numerous, according to the survey findings, but their incidence appears to be highest in small shops. Home accidents rank highest of all designated classes of accidents. There is a fertile field here for intensive and comprehensive accident prevention programs.

The distinctly higher accident rate found in deteriorating, overcrowded neighborhoods in Worcester has been observed elsewhere. In Baltimore, in a study on the effect of housing on health (*19, 20*), it was noted that "accidents were one-third lower in the housing project as compared with the slums." In Worcester,

results of preliminary census tract studies suggested a similar correlation between slums and high accident rates. The need for parents and communities to provide more supervision of the young while playing is clear. At the community level, there is need for better provision of adequately supervised play areas available to residents as near their homes as possible. Playing on streets and busy thoroughfares should be discouraged.

Some unusual accidents were reported, such as accidents to operators of high-speed craft on water and to swimmers by propeller shafts. Accidents caused by implements such as power mowers are also noteworthy.

During the accident survey, the Worcester Department of Public Health provided frequent releases to the press and to radio stations, and these are being continued. The most significant result of the survey, however, has been the permanent system of reporting accidents set up by the Worcester hospitals. These reports cover accidents to inpatients only. They are sent to and are tabulated in the health department.

During the first year following completion of the survey, the participating hospitals sent to the health department reports of accidents to outpatients. However, because of the monumental amount of work involved, these were dropped at the end of the year. Study of these outpatient reports suggests that there has been a distinct and perhaps significant drop in poisoning cases since the end of the study year, but this trend will have to be observed further before definite conclusions can be drawn. The considerable publicity given to the accident survey may have contributed to this trend. Health education efforts obviously must continue indefinitely.

Accident prevention is a vital program, in which the physician, the hospital, and the health department each has a distinct role to play. However, they must first accept this responsibility. In Worcester, this responsibility is beginning to be shouldered, but there is still no reason for complacency.

Summary and Conclusions

Results of the Worcester Accident Survey conducted July 1, 1957–June 30, 1958, indicate that the city's accident problem is a massive one. Although some details are not unexpected, the findings indicate that many factors must be considered before meaningful accident prevention programs can be carried out. The relationship of deteriorating properties and neighborhoods to the accident problem is clear and is probably significant.

The health department's role in accident prevention, like that of other public enforcement agencies, would appear to be at least twofold: (*a*) enforcement of pertinent codes, such as housing standards; and (*b*) education of the public, segmentally and at large.

In Worcester, the number of on-the-job accidents found by the survey was higher than expected. There is need for enforcement agencies to work with local industries, particularly with small shops employing 100 or fewer workers, to help them do a better job of accident prevention. The insurance industry also has a role to play here. The services of specially trained sanitarians hired by the health department to act as advisers to these small shops might be used to supplement the work of agencies such as the Massachusetts Department of Labor and Industries.

Perhaps the most significant single fact brought out by the Worcester survey is the need for parents of very small children to prevent tiny hands from reaching dangerous materials, such as household poisons. It is even more important for parents to see that children are supervised at all times while playing. Older children, when taking part in organized sports, should be provided with appropriate play areas and equipment and should be under supervision and firm adult leadership at all times.

The health department has a particularly significant role to play in preventing accidents, particularly home accidents, through education and through enforcement of pertinent codes. However, all agencies which have any part in accident prevention should work together.

REFERENCES

(*1*) National Safety Council: Accident facts. 1958 edition. Chicago.

(*2*) U.S. Public Health Service, Accident Prevention Program: Accidental injury statistics. Washington, D.C., June 1958.

(3) U.S. National Office of Vital Statistics: Accident fatalities. United States and each State, 1956. Vital Statistics—Special Reports, National Summaries. vol. 48, No. 11, Sept. 15, 1958.

(4) McFarland, R. A.: Health and safety in transportation. Pub. Health Rep. 73: 663–680, August 1958.

(5) McFarland, R. A., and Moore, R. C.: Human factors in highway safety. A review and evaluation. New England J. Med. 256: 792–798, Apr. 25; 837–845, May 2; 890–897, May 9, 1957.

(6) McFarland, R. A., Moore, R. C., and Warren, A. B.: Human variables in motor vehicle accidents; a review of the literature. Boston, Harvard School of Public Health, 1955.

(7) McFarland, R. A.: The role of human factors in accidental trauma. Am. J. M. Sc. 234: 1–27, July 1957.

(8) The role of preventive medicine in highway safety. Am. J. Pub. Health 47: 288–296, March 1957.

(9) Cambridge, Mass., Department of Public Health: Summary of accident prevention projects, City of Cambridge, 1951–1956.

(10) Accident toll at the school age. Statist. Bull., Metropolitan Life Insurance Co. 36: 1–3, August 1955.

(11) U.S. House of Representatives: Report on environmental health problems. Document No. 52946. 86th Cong. Washington, D.C., U.S. Government Printing Office, 1960.

(12) Fatal injuries in competitive sports. Statist. Bull., Metropolitan Life Insurance Co. 41: 8–10, May 1960.

(13) Decrease in frequency of drowning. Statist. Bull., Metropolitan Life Insurance Co. 40: 9–10, June 1959.

(14) The accident toll in 1959. Statist. Bull., Metropolitan Life Insurance Co. 41: 7–9, January 1960.

(15) The frequency of accidental poisonings. Statist. Bull., Metropolitan Life Insurance Co. 41: 8–10, March 1960.

(16) How fatal accidents occur in the home. Statist. Bull., Metropolitan Life Insurance Co. 40: 6–8, November–December 1959.

(17) Otterland, A., and Roos, B: The human factor in shipwrecks and other accidents to ships. Brit. J. Prev. & Social Med. 14: 49, April 1960.

(18) Many women killed in accidents. Statist. Bull., Metropolitan Life Insurance Co. 41: 8–10, June 1960.

(19) Wilner, D. M., Walkley, R. P., Williams, H., and Tayback, M.: The Baltimore study on the effects of housing on health. Baltimore Health News 37: 45–50, June 1960.

(20) Good neighborhoods have low accident rates. American City 47: 23, August 1959.

Infant Deaths From Coxsackie B Infection

Coxsackie B virus infection caused heart damage fatal to five St. Louis infants during a 2 month period in the fall of 1960. Dr. Robert E. Fechner and Dr. Margaret E. Smith, pathologists at the Washington University School of Medicine in St. Louis, reported on the epidemic at the annual meeting of the American Association of Pathologists and Bacteriologists in Chicago on April 27, 1961.

The infants were delivered in four different hospitals. They died 1 to 5 days after onset of symptoms which included respiratory distress, lack of appetite, and lethargy. Autopsies showed severe inflammation and extensive necrosis of the heart muscle, and also a less severe encephalomyelitis.

Dr. Fechner said that diseases attributed to Coxsackie viruses frequently occur as epidemics but usually are not fatal except in infants.

The Administrative Arts

The relation of mental health programs to public health activities and how to coordinate the two was the general theme of the Conference for Mental Health Nurse Consultants, held in Newport, R.I., September 28, 1960. Presented here are two papers on methods of improving services to patients and their families through modification of organizational structures and practices and through interagency program cooperation, following principles that may be applicable to various service agencies.

Organizational Factors Essential to Service

LEON STERNFELD, M.D., health commissioner, Cambridge, Mass.

From the administrative standpoint there are three components which agencies can manipulate in order to improve their services. These components consist of: (*a*) various factors within the agency itself, (*b*) those factors pertaining to patients and their families, and (*c*) those involved in the interaction between the service agency and persons receiving services.

Self-Improvement

Legal backing, one of the factors inherent within the agency, is of prime importance as it provides for the actual existence of the agency. Official agencies have such backing through Federal and State laws and local ordinances. Officially issued charters and legal incorporations provide the backing for voluntary agencies. Advantageous as this may be, there are certain disadvantages which can, and do, interfere with the quality of services.

All too frequently, both official and voluntary agencies were established many decades ago and the legal provisions for their establishment reflected the needs of the time. The intervening years have brought about drastic changes in such needs, and a constant review, with suitable modifications if indicated, should be made in the legal provisions to reflect the changing requirements. Many official health agencies, particularly local ones, are still complying with outmoded laws and ordinances in regard to environmental sanitation and control of communicable diseases.

Equally detrimental are some of the provisions of voluntary agency charters. Recently a decreased budget forced an outstanding urban nursing service to curtail its prenatal nursing services because a statement in its charter provided that the agency should "take care of the sick poor." This was interpreted as meaning primarily the provisions for bedside nursing services despite the great need for prenatal services. The overall community health requirements became secondary to the charter provisions of that agency.

Closely related to the legal factor, and necessary to its implementation, are policies and procedures. They have often evolved in a haphazard, illogical, and expedient manner, and alterations in them have occurred in a similar fashion. Frequently the actual procedures of the agency's staff are quite different from those set down in the policy and procedure manuals. In fact, many agencies have not systematically organized their policies and procedures into

manual form. Thus, depending upon the individual interpretation of each staff member, many diverse, and contradictory, policies and procedures are carried out.

Constant review, modification, and accurate interpretation of agency policies and procedures, as well as high-quality supervision of staff performance, are needed to insure good service. Utilizing experience and suggestions of the staff, advisers, and the clients themselves, agency executives should continually carry out such reviews and modifications. It is wise, also, to seek the recommendations of outside consultants periodically.

There are two distinct, although interrelated, groups of policies and procedures. One deals with professional activities; the other deals with supportive activities necessary to expedite the professional activities. How often do clerical and office procedures tend to become an end in themselves rather than a means of giving superior services to clients and their families? How many of us are familiar with the dismal spectacle of professionally trained personnel spending a large portion of their time in clerical procedures which, even if essential, could be handled more efficiently by lesser trained persons?

Legal backing and policies and procedures are, after all, instruments for effective performance of services. Good services do not happen accidentally but are deliberately designed. The essential in such a design is the establishment of standards which may be broadly classified into minimal, recommended, and optimal. These requirements should be flexible. Each agency must establish basic standards below which performance will not be carried out. Each agency must have as its goal the constant improvement of its standards and not remain content with performance at minimal requirements. Supervisory or regulatory boards frequently establish standards geared to the abilities of the poorest agency. Certainly agencies capable of maintaining higher standards should be urged to do so.

Another important factor inherent within the agency itself but vital to the improvement of agency services, is program evaluation. Although difficult to achieve in actual practice, such evaluation should be built into the basic program plan so that it becomes part of the day-to-day activities. Many agencies do obtain complete and fairly accurate information about the number and types of their activities, but, useful as these data may be, they cannot be used comparatively either with material from other agencies or in the agency itself over a period of time. This type of information provides the numerator of a ratio in which the denominator, the potential population base to whom services should be given, is most difficult to determine, certainly by any one agency in the community. All agencies in moderate-sized communities should pool their resources into a combined effort to ascertain such basic data. This would give each agency an opportunity to calculate appropriate evaluation ratios which would be of importance in program modification and improvement of services.

Development of satisfactory indices for qualitative measurement of services is urgently needed. Professional groups have been working on this problem for years and it is hoped some progress can soon be made. Until such indices are perfected, agencies must rely upon quantitative measurements in program evaluation.

Although it is generally accepted that training and research should be a function of service agencies, most of them neglect these important areas. Every service agency has an obligation to cooperate in the training of professional personnel despite any rationalizations that such training and research are luxuries they cannot afford. Institutions for professional training find it very difficult to obtain sufficient field placements for their students despite the acknowledged shortage of all types of trained personnel. If their services are to be continually improved, each agency must participate in training and research which, far from being luxuries, are absolute necessities.

The critical factor in any service agency is its personnel. The overwhelming importance of a qualified staff under competent supervision and direction hardly needs to be reemphasized. By and large, voluntary agencies have been superior to official agencies in this respect, but all suffer from the lack of complete staffs of qualified persons.

As intricate and frustrating as is this lack

to agency executives, many more complications occur when unqualified people are providing services for clients and their families. More harm and damage are caused than would occur were positions vacant in the agency. A vacancy somehow appears to be a vacuum that cannot be tolerated and therefore an unqualified individual is selected and the vicious cycle continues. Although unqualified persons, carefully selected, may, in time, be developed into qualified persons by nurturing, guidance, and supervision, these conditions are rarely present. Orientation, inservice training, workshops, supplemental academic instruction, reading of professional literature, and case conferences are necessary for the basically qualified professional person, but they cannot and should not be substituted for basic professional training.

Much of modern personnel administration has developed through the stimulation of "big business" where benefits can be quickly measured in terms of profits. It is a curious schism in our country that what is profitable in dollars for business rarely has been translated by voluntary and public agencies into "profits" for clients. The spread between "private wealth" and "public poverty" increases rapidly, not only to the detriment of service agencies but to their clients and families and thus ultimately to the entire community.

Clients and their families frequently focus on one presenting problem. Little, if any, headway can be made working with such clients. It is rare, indeed, for the presenting problem to be the only one. All too often there is a complex of social and health problems of which the presenting one is only the most obviously recognized, but which is frequently only secondary. Experience indicates that it often is necessary to solve some of the other difficulties in order to achieve any beneficial results.

Such a situation must be recognized and dealt with in a systematic and competent fashion. Shunting a client from agency to agency without any one of them assuming responsibility for followthrough and followup is to be severely condemned.

Client and Agency Interaction

Interaction between client and agency is intricate and subtle, involving many factors not actively recognized by either. It is a truism, often neglected in practice, that an agency should know its own community. Much information is available about communities: demographic characteristics, housing, industrial and business establishments, schools, and health and social resources. Unfortunately, a great deal of this basic information suffers from two faults—inaccessibility through scattering and diversification, and rapid outdating. Methods should be developed whereby all such basic community data can be collated rapidly and disseminated widely.

It is time the public realized there are no bargains in agency services. Good services are expensive but ultimately much less so than parsimonious purchasing of lesser quality services. No one argues for needless expenditures or for waste or inefficiency, but it is far better that there be some waste than to deprive needy clients and their families of good services. Agencies do have a responsibility in this matter and should not be forced into a defensive and apologetic position as they so frequently are. This factor of adequate financing of agency services needs no further discussion except to note that interagency coordination is one way to effect efficiency and eliminate waste.

The Patient and His Family

Before a person becomes a client, the following process occurs: a problem or problems develop; there is recognition and definition of the problem; personal and family resources are mobilized to attempt a satisfactory solution; and, if these efforts are unsuccessful, outside resources are sought and their help enlisted. Of what aid can an agency be in this devious process? The most desirable achievement would be the prevention of problems. Yet it appears that most agencies are "problem centered" and geared to diagnostic and ameliorative actions rather than to outright prevention.

Until outright prevention can be achieved, curative services must be provided. How many agencies have developed a means of assisting families to recognize and define their problems

so they will seek help at the earliest possible time rather than allowing delay to intensify them? The accessibility of an agency, or its lack, is an obviously important factor. Because of staff and financial limitations, many agencies must make hard decisions which inevitably affect the quality of their services. Waiting lists are well known in many agencies. Because of heavy pressures the amount of service given any one client may be drastically curtailed. Priorities on types of problems handled are established. In these and other ways needed services are curtailed. Such curtailments, however, should be subject to constant and vigilant review and appropriate adjustments readily made so that a temporary necessity does not develop into a comfortable and permanent routine. As broad a segment of the community as possible should be made aware of the situation in order to enlist the necessary understanding and support for required corrective action.

In addition to enumerative community data, other information is needed if agencies are to improve their services. This type of information relates to the behavior of people in the community—their attitudes and values, their customs and patterns of living, their beliefs and prejudices—in short, information that can be obtained by methods being developed by behavioral scientists. These studies are now being carried out extensively, and application of the study results should enrich the services of agencies. However, agencies are not always enthusiastic about such studies, and resistances do occur in these study areas. Methods are needed for effectively dissipating or preventing these resistances. Related and overlapping areas of study are those of communication research, motivation research, and psychosocial behavior. The potential value of these studies can scarcely be questioned, particularly in their practical application whereby agencies may then improve their services to patients and their families on a logical and systematic basis.

Summary

There are a number of items, some relatively simple, others quite complex, which any agency can consider in its effort to improve services. Of course, consideration of some or all of these does not of itself lead to corrective action, but recognition of the needs for correction and the agency's responsibility in achieving this is an important step forward and, when coupled with a dedicated and sincere desire for improvement, will ultimately result in higher quality service.

Personalities and Dynamics In Interagency Cooperation

JOSEPH ADELSTEIN, M.D., director, bureau of mental hospital services, Pennsylvania Department of Welfare, Harrisburg.

Public health programs and mental health programs are administered by separate agencies. Recognizing that agency relationships at best are difficult, the primary question is how they can be improved and the possible conflicts and friction overcome. By uncovering the dynamics and significant opposition encountered in the interagency associations of these two programs we may find some basis for "therapy."

First we must understand how these programs developed. Historically, public health and mental health programs arrived at their present point of union from two approaches almost antithetically opposed. Public health had its origin in concern with various factors affecting the health of groups and with how to control disease-producing factors in the environment as well as how to strengthen the resistances of entire populations to disease. The whole orientation was very much a community one. It is only recently, as the communicable diseases have been brought under control and the chronic disabling illnesses have become more common, that we see increasing interest in preventive and rehabilitative services that are patient oriented.

On the other hand, mental hygiene, or mental health programs, had its origin in clinical psychiatry, which in turn was strictly patient centered and very little concerned with the community. It was only a short time ago that psychiatry began to show interest in the community, in the disease-producing stresses of the environment, in approaches toward prevention, and in recognizing that much of the community

plays a very important part in the success or failure of treatment and rehabilitation programs.

Although the two approaches have been poles apart, both have been closely related to the social welfare movement: public health because so many disease conditions attributable in the past to harmful environment have been found associated with poor socioeconomic conditions, and mental health because so many people suffering from mental illness needed long-term custodial care far beyond the means of most individuals and families.

In most areas the majority of our modern therapeutic mental hospital systems developed from a system of institutions that were essentially oriented, from the public's viewpoint, to provide decent custodial care for individuals who could not be cared for in the community. Thus, traditionally, they were developed as welfare rather than medical functions since the provision of housing and sustenance for society's poor unfortunates has always been looked upon as a welfare function. Therefore, one of the major public health problems, requiring perhaps the greatest amount of integration of all resources, often exists outside established health and medical facilities of the community. Society only now is beginning to accept that what is indicated here is not a custodial program for its unfortunates but a therapeutic program for its sick.

There is general agreement with the statement expressed by the Committee on Mental Health of the World Health Organization that "some of the most important opportunities for improving mental health now lie with workers in the public health service." Treating patients in a mental hospital makes us realize that, significant and vital as it is to help individuals desperately in need of it, this approach in no way comes close to meeting the challenge of controlling mental illness in our population. Additional experience convinces us that public health principles applying to other diseases work equally well in mental illness. No disease is controlled solely by developing effective methods of individual treatment without concern for prevention and rehabilitation.

It is recognized that treatment of mental illness in hospital or clinic is but an episode in its course, the actual course and eventual outcome often being determined by what precedes and follows the treatment. From this realization it is only a step to the next. To treat the patient and all of his illnesses effectively rather than a part of them, ways and means must be found to integrate community resources before and after specific psychiatric treatment so that the patient and his family may be supported by a continuum of planned integrated care instead of by isolated and unrelated attacks upon various aspects of his illness. Such a fragmented approach often defeats itself. The only conclusion to be drawn is that the ultimate achievement of good mental health care, both prevention and treatment, depends upon the extent to which it is integrated into the public health services of the community.

Agency Interaction

In order to shed some light on the difficulties which may be encountered in getting public health officials and personnel to accept mental health programing, three broad areas, discussed in detail by Paul V. Lemkau in his textbook, "Mental Hygiene in Public Health," should be considered.

First, there is the suspicion on the part of public health workers that mental hygiene is not a science but an art and as such is not amenable to the objective methods of control and evaluation that public health personnel are accustomed to in the communicable diseases, in water and sewage control, and in air pollution. Even when mental health programing and personnel are accepted as part of a public health program, it is more with a good-natured air of tolerance for someone who means well and probably is doing some good, but no one is quite sure of what is being done or what it means. In really effective programing, there is quite a difference between good-natured tolerance and real acceptance.

Second, mental health in the past, as pointed out previously, has concerned itself mainly with providing therapy to individuals rather than with prevention, in contrast with public health. It is only recently that mental health workers are talking concretely about techniques of secondary prevention, a concept that is completely

familiar to public health workers, and even of techniques of primary prevention that essentially have to be developed through public health services. However, again because mental health endeavors have been for so long completely outside the mainstream of established medical and public health practices, mental illness itself is still a rather strange and unknown subject to many, requiring considerable effort for intellectual digestion without biting off the even more difficult concept of prevention. And, vice versa, psychiatrists and other members of the mental health team traditionally have been clinically trained and oriented and have little cognizance of the skills and knowledge involved in the discipline of public health with the result that this group does not easily accept the role of public health personnel in preventive and community mental health organization. Yet it is the public health officer and employee who have been especially trained to deal with disease and promote health on a communitywide level.

Third, and perhaps one of the most important factors in motivating individual behavior and in maintaining the gap, is the fear, conscious or otherwise, on the part of public health officials that integration of the mental health program with the public health program would mean the swallowing up of the public health program. This is a very realistic fear and one that calls for careful consideration as closer cooperation and integration develop. Since mental health programs have been concerned with the operation of large hospitals, their budgets and personnel usually dwarf most existing public health programs. And then, of course, there is the opposite side of the coin. Many mental health workers take a great deal of pride in finally achieving a degree of recognition and are fearful of losing the initiative and opportunity for developing a really effective program by becoming too closely identified with another group.

Let me hasten to add that I do not think that forces which tend to insure that cooperation between public and mental health practices will be superficial represent ill motives on the part of individuals. Rather, I think we must face the fact that agencies are institutions in the strict sociological meaning of the word and impose patterns of behavior on individuals that they may not wish or intend. Like it or not, our ways of operating are as much a reflection of the agency in which we are working as they are of ourselves. Frankly, it is only by overcoming our own biases, prejudices, and resistances that we come to accept that others, no matter how opposed to us or how different their ways of operating, are as sincerely motivated as we in bringing help to those in need. Only then will we be able to work through and overcome the differences that are imposed on us by our agencies because of their different developmental histories.

So far we have discussed, in general, agency "personalities" and agency dynamics. But what of the individuals in these agencies? What resistances do we encounter or expect to encounter in public health personnel that are not agency related?

Individual Resistances

Mental hygiene encroaches on areas in which sanctions derived from religion, ethics, and social conventions operate. Emotional resistances may be aroused in these areas. The successful permeation of public health practice by mental hygiene activity depends in part on health workers acquiring insight into such prejudices and being able to evaluate them objectively.

Another source of resistance on the part of the public health worker toward active cooperation with mental health programing is fear. This fear has two aspects: first, the feeling that mental illness is something strange and bizarre and, second, the feeling of inadequacy to cope with the illness. It is natural to avoid situations and relationships that give rise to these feelings.

Wise administrative practices do much to improve interpersonal relationships on the part of the staff and relieve anxieties, tensions, and frustrations, thereby enabling staff personnel to relate much better to the patient they are working with. It is extremely doubtful that a tense, troubled professional worker can be of much help to a troubled individual dependent, in turn, upon her.

At times I have seen other types of resistances develop that in a sense are exactly opposite.

Many of our more experienced people, especially nurses, are extremely sensitive, with considerable insight and intuitive knowledge of human nature and mental illness although they have never been able to verbalize their knowledge. Many, whether they recognize it or not, have applied mental hygiene in dealing with patients and their families. Then, along comes a mental health consultant, whether a nurse or social worker, who is verbal in the mental health field, extremely facile in using proper terms and in explaining psychodynamics, and who begins to give consultation and advice on various aspects of the cases public health personnel are working on. This information may be imparted as though it is a completely new body of knowledge, possessed only by mental health workers.

Public health workers soon recognize, however, that what the consultant is talking about is not new or different. She is talking about techniques which they have learned instinctively through many years of experience and which are just as valid as the so-called new ones. Here is where the consultant's sensitivity and tact play such a vital role. The consultant who can sense this situation and bring it out into the open, giving recognition to this wealth of experience and knowledge as being proof that mental hygiene programing is only something being done that needs formalizing and strengthening, is bound to win active support and cooperation for a mental health program. On the other hand, the consultant who misses this is likely to arouse so much antagonism and resentment, even scorn, that it will be extremely difficult to enlist real cooperation.

It is not unusual to find people engaged in mental health activities in various agencies who actually feel that mental health programing is their sole prerogative and that no one else should be in this area without their express permission. Although there is no doubt that setting up the mental health authorities was essential for the proper control and channeling of Federal funds for mental health, it seems that in many instances this structure has led to the point where the mental health authority feels it is the sole judge and arbitrator of everything concerned with mental health in its area. The result has been that other agencies in the same area, even public health agencies, feel they have no right to concern themselves with matters of mental health. This, of course, does little to foster good interagency relationships in the mental health field.

In conclusion, I see the mental health nursing consultant being very much aware of the need for interagency programing to bring well-rounded care to patients and families. Even more important, I look to the mental health nursing consultant as the one person who can understand that working through the inevitable interagency and interdisciplinary conflicts is the real issue which has to be met before programing can occur. To be able to accept these conflicts as the real challenge is to change a frustrating situation into a satisfying one.

Housing Hygiene Training Program

The activities of the Public Health Service Housing Hygiene Training Program have been transferred from the Communicable Disease Center to Service headquarters in Washington, D.C. Inquiries and requests for consultative services should be directed to the Technical Services Section, Division of Engineering Services, Bureau of State Services, Public Health Service, Washington 25, D.C.

Social Service in Homes for the Aged

FRANZ GOLDMANN, M.D.

IN RECENT YEARS many homes for the aged have developed into nursing homes for physically or mentally disabled persons of far-advanced age. This change in function was prompted by the marked increase both of infirm old people seeking admission and of residents beyond 80 years who were physically or mentally declining during their long stay in the home.

Acceptance of new responsibilities has been accompanied by adjustments in the organization of personal health services. Numerous homes have built up regular professional staffs of persons with various special skills; acquired diagnostic and therapeutic equipment of various types or arranged to use such equipment in nearby hospitals; established, or expanded, special units for the sick; and made informal arrangements with general hospitals for inpatient and outpatient care of those residents who could not be treated at the home. Going beyond this pattern, some homes have entered into definite cooperative agreements with general hospitals through which physicians on the hospital staffs provide service at the homes.

Addition of social workers to the staffs is part of the new policy. How far has this development progressed in a group of nonprofit institutions under identical auspices? What specific functions are performed by the social workers? Answers to these questions were obtained through inquiries made in connection with a series of studies on coordination of health services for patients with long-term illness. These studies were sponsored by the Council of Jewish Federations and Welfare Funds and supported by a grant from the Division of Hospital and Medical Facilities, Public Health Service.

Dr. Goldmann is associate professor of medical care, emeritus, Harvard School of Public Health, Boston, Mass. When the studies reported here were made, he was director of health study for the Council of Jewish Federations and Welfare Funds, New York, N.Y. Lily P. Silbert and Ethel A. Wilson, research assistants to the director, contributed to the analysis of the material.

Employment of Social Workers

Data on employment of social workers in 1957 were collected as part of a detailed study of the organization of personal health services in 70 Jewish homes for the aged in the United States and Canada, which accommodated approximately 11,000 people at the time of the inquiry.

Qualified social workers were on the staffs of 44 of the 70 homes. Full-time workers were employed in 33 homes containing 74 percent of all available beds and they were assisted by part-time staff members in a few of the homes. At 11 homes, with 8.3 percent of all beds, only part-time social workers were employed.

A breakdown of these figures by size of home showed that full-time social service was practically the rule in institutions with more than 200 beds but infrequent in smaller homes. Full-time social workers were found in one home with 34 beds, in 15 of the 36 homes in the 50- to 199-bed category, in all but 1 of the 14 homes with 200 to 399 beds, and in all four homes with 400 or more beds. Part-time social workers as the only representatives of the profession were employed in five homes with bed capacities between 23 and 47, in one 52-bed home, in one 77-bed home, in three homes in the 100- to 199-bed category, and in one 205-bed home.

There were no social workers on the staffs of 26 homes containing 13.7 percent of all beds. All these homes had fewer than 200 beds, and most of them fewer than 100 beds. However, 11 of them, with about 4 percent of all beds, regularly used the services of caseworkers of social agencies in the community, such as family service agencies.

It can be concluded that more than 85 percent of the 11,000 residents of the 70 homes had access to a social worker.

The number of social workers in relation to the number of residents or the number of beds is, of course, very important to the evaluation of the situation. For this analysis, 100 beds were used as the unit of measurement since the number of beds represented fairly accurately the number of residents. In 1957, the median occupancy rate of the 44 homes was 93.6 percent. The number of all social workers per 100 beds equaled one or more in 15 homes and less than one in the remaining 29. Since no standards of quantitative adequacy have been developed, the significance of this finding cannot be assessed.

Functions of Social Workers

During certain periods of 1958, 530 residents of five Jewish homes were studied by teams of physicians, nurses, social workers, and administrators on the staffs of the homes. The institutions were located in Chicago, Miami, Philadelphia, St. Louis, and Toronto. All the homes had more than 50 but fewer than 400 beds, the category containing seven-tenths of all the beds in the 70 Jewish homes from which data on social service staffs had been obtained.

As part of these case studies information was gathered on the extent of social service and the specific functions performed by the social workers. To give the findings proper perspective, the setting in which the social workers were acting must be described briefly.

At the time of the study more than one-half of the people living in the five homes were 80 years or older, 3 out of 4 were widowed, and more than 8 out of 10 were dependent for their support on social security benefits, public assistance, or both sources. One-half the residents had been living in the home at least 3 years, the majority of these 5 years or more.

Almost all of the residents were in ill health, suffering from multiple chronic ailments, and many were severely disabled. Mental impairment with symptoms of temporary or continuous confusion was the most common affliction; it was found in more than 4 out of 10 persons studied. Marked emotional disorders were widespread among the others. Nearly one-half of all the residents were so seriously incapacitated that they required care in a special unit, such as an infirmary or a hospital division of the home. Details have been described elsewhere (*1*).

All five homes had at their disposal both special facilities and professional and auxiliary staffs. Four homes possessed clinical laboratories, X-ray laboratories, electrocardiograph machines, operating rooms suitable for minor surgery, dental divisions, and equipment for physiotherapy and occupational therapy. The fifth home, located in the same building as a well-equipped chronic disease hospital, had ready access to such facilities. Special units for the sick were operated by all the homes. The beds in these units represented 24, 24, 44, 48, and 60 percent, respectively, of the total bed capacities of the five institutions. The regular staffs of all five homes comprised physicians, including representatives of all major specialties, dentists, professional and practical nurses and nurse aides, laboratory technicians, physiotherapists, social workers, and specialists in recreational work. In addition, podiatrists, optometrists, or occupational therapists were on the staffs of some of the homes, and a psychologist was in regular attendance at one home.

The time spent by physicians on service at the home during a typical week equaled 12 hours per 100 beds in one home and exceeded 25 hours in the other homes, the maximum being 39 hours. The rate of all types of nursing personnel ranged from about 11 to about 32 per 100 beds and the rate of professional nurses ranged from 1.4 to 4.7 per 100 beds. At the time of the study nursing service was received by 9 out of 10 persons in the residential units of the homes and by all those in the infirmaries or similar divisions.

The social service staffs numbered one full-time worker each in three homes and one full-time and two part-time workers in one home.

For the home in the building with the chronic disease hospital, three full-time workers served both the home and the hospital. Excluding this home, the number of social workers per 100 beds equaled 0.4 in one home, 0.7 in two homes, and 1.2 in one home.

Two-thirds of the 530 residents were receiving social service at the time of the study. However, this average conceals exceedingly wide variations among the homes. At one home every fifth resident was assisted by social workers and at another every resident. In the other three homes, two-fifths, three-fifths, and four-fifths of the respective residents were currently attended by social workers.

Specific activities carried out by social workers averaged three per resident served. The rate of activities was highest in the two homes where all or most of the residents were assisted by social workers; it was lowest at the one home where a small proportion of all residents were receiving such help. Thus, there was a striking correlation between frequency of assistance by social workers and average number of specific activities per person receiving social service.

Of specific activities, counseling with the residents was most frequent. Next came, in this order, collaboration with nurses, collaboration with physicians, and counseling with members of the residents' families. Together these activities accounted for more than four-fifths of the total. The remaining activities consisted mainly of arrangements for sheltered employment and for recreation outside the institution. At one home, the social worker's duties included requests to the families to help pay for drugs and appliances.

Counseling with the residents ranked first in demands on the time of social workers as well as in frequency. Counseling with relatives of the residents, collaboration with staff physicians, and collaboration with nurses were, in this order, the other most time-consuming functions.

Problems to be tackled by social workers on the staffs of homes for the aged are peculiar both in nature and in scope because of the influence of four, often interdependent, factors: congregate living, long stay, high frequency of substantial physical or mental impairment, and prevalence of emotional disorders. To deal with these situations, social service must be provided at the time of admission of a resident, if not at the time of the application, and it must be continued for many weeks or months, and often for years, at least intermittently. Such a policy was the rule at all five homes studied.

The following two examples show the emphasis placed on participation of social workers in the evaluation of applicants and in service to new residents. At one home all admission procedures are under the supervision of the social service department. The physicians and social workers on the staff decide jointly whether an application should be accepted and if so, whether it should be given priority. Residents receive casework service immediately after admission. At another home, each new resident goes through an "orientation process" of 6 weeks during which every effort is made to establish all facts on physical and mental condition, social adjustment, and requirements for special services, such as occupational therapy.

Many persons entering a home for the aged feel lost in the new environment. Some cannot cope with the abrupt transition from loneliness to togetherness. Some harbor bitter feelings against relatives who have "abandoned" or "rejected" them. Some are distressed by the necessity of sharing a room with a person differing in background or interests, and some cannot reconcile themselves to the fact that they are no longer self-sufficient and capable of self-care. Newcomers are often easily annoyed by other residents and quick to complain or to start an argument. Sometimes they become hostile or depressed.

Adjustment of the resident to the environment, especially to group living, is one of the aims of casework service. Typical examples from the case studies are an 85-year-old man who is "nongregarious" and "always ready to question all procedures"; an 81-year-old man who "feels superior to other residents," influences some in adverse manner, and needs "a better outlet for his energies"; and an 81-year-old woman who needs "considerable reassurance" concerning an inactive tuberculosis as well as "assistance in adjustment to institution and partner."

Some of the residents who originally found

it very hard to accept life in an institution gradually become accustomed to it and seek the social workers for supportive help only once in a while. Others continue to require counseling service time and again, as a 75-year-old man who throughout his 4 years of residence had been a "trouble-maker" because he tended to "become easily argumentative with other residents." Not infrequently, emotional problems, mainly anxiety, develop with deterioration of the resident's physical condition or occurrence of an intermittent disease. Illustrations are a 77-year-old woman with chronic glaucoma who was haunted by the fear of complete blindness; an 81-year-old woman with carcinoma of the rectum who was "unable to face reality" and exceedingly demanding ("all is not enough"); a 74-year-old man with progressive osteoarthritis of the spine and obliterative arteriosclerosis of the legs who could not resign himself to being bed bound and restricted in functions of daily living; an 82-year-old woman who was "a well-adjusted happy person" until she had a severe case of herpes zoster causing despondency; and an 80-year-old woman who after 14 years in the home had several severe falls and was frightened by the very thought of walking.

Although continued, and at times intensive, counseling service to mentally clear residents with emotional disorders was a major activity of the social workers, some service was given to almost as many mentally confused as mentally clear residents. It ranged from "minimal counseling" for persons with severe disturbances to frequent "friendly conversations" with mildly confused residents. Occasionally, a social worker visited such residents daily in an effort to improve their relationships with other residents, nurses, and relatives. As a rule, the counseling was part of the total treatment plan, carried out in close collaboration with the attending physician, often a psychiatrist, the floor nurse, and the occupational therapist. Significantly, two-thirds of the residents with emotional or mental disorders could be helped mainly by counseling from social workers as well as by constant reassurance from the nursing personnel; they needed only occasional psychiatric service. The remaining one-third required more or less regular psychiatric treatment complemented by some social service (*2*).

Counseling with the families of residents, the second most time-consuming activity of the social workers, aimed at two principal objectives: to obtain cooperation in the care of the resident and to assist the relatives themselves. In some instances the family did not understand the behavior of a seriously ill resident, the purposes of the services provided, or the willingness of the home to help the resident. In other instances, the family's active cooperation was necessary to influence the behavior of the resident. In still other instances, relatives required assistance to withstand the stress of witnessing a resident's long suffering. Accordingly, the social worker's activities ranged from interpretation to treatment.

The social workers on the staffs of the five homes were keenly aware of the limitations of their work. Although casework service was given to two-thirds of all residents at the time of the study, its intensity was not always sufficient. This fact was freely admitted by the social workers. For instance, a 75-year-old mentally clear man, in the home more than 3 years, needed "more counseling time than can be allotted to him," and a 79-year-old mentally confused woman, in the home more than 6 years, required "more consistent individualized attention." In view of the caseloads carried by the social workers these remarks may well apply to many cases.

Discussion

It is heartening to find that some 80 percent of the 11,000 residents of 70 Jewish homes for the aged in 1957 had the opportunity to receive service from social workers on the regular staffs of the homes and that an additional small proportion could be assisted by caseworkers affiliated with social agencies in the community. This, however, is not the full story. The question, "Is there a social worker in the house?" could be answered in the affirmative by only 44 of the 70 homes. Whether the 26 homes without social workers on their staffs can serve their residents properly seems doubtful.

Employment of full-time social workers was more frequent with increasing size of the institution; it was found at all but one of the homes with more than 200 beds. It is significant that

the homes with full-time social workers provided 74 percent of all beds although they made up only 47 percent of all homes.

How many residents can a full-time social worker effectively handle under certain clearly defined circumstances? This question is begging to be answered. Development of standards by an authoritative body would be of help to those homes that want to extend and improve their social services.

The analysis of the functions of the social workers at the five homes underlines the importance of a good social service department. The predominance of counseling with the residents could be expected in view of their particular needs. It is especially interesting that the social workers gave so much of their time to counseling with families of the residents. By establishing and maintaining liaison between the home and the family the social workers contribute not only to better care of the resident but also to better understanding of the role of the home.

Another highly important activity of the social workers was interprofessional cooperation. Collaboration with the nursing personnel was even more frequent than collaboration with physicians. One may well conclude that the principle of coordinating services for the residents can be applied easily if there are social workers on the regular staffs of the homes.

Inevitably, the findings reported here raise an important question: Are the Jewish homes for the aged typical with respect to provision of social services? At present, no answer is possible because there are no detailed studies of social service at other groups of homes for the aged. This gap in our knowledge should be filled soon. Once this is accomplished it will be easier to plan for the best possible development of social service in homes for the aged, that essential component of total care of residents.

REFERENCES

(1) Goldmann, F.: Residents of homes for the aged. Geriatrics 15: 329–337, May 1960.

(2) Goldmann, F.: Medical care of the mentally impaired in homes for the aged. Am. J. Pub. Health 50: 1687–1694, November 1960.

Hospital and Medical Economics in Michigan

The University of Michigan has just completed the largest independent analysis yet made of medical and hospital economics in a State.

The 3-year study revealed that patients who stay in the hospital even a day or two longer than necessary can add as much as $15 million to the State's hospital bills in a year. On the other hand, patients who leave the hospital too early may need additional services amounting to as much as $5 million if minimum standards for medical care are to be met.

The study also found that the health insurance of most families in Michigan is insufficient to take care of major hospital and medical expenses. The report recommends improvement of health insurance coverage for aged and low-income families, continued protection for unemployed and retired workers, and broadening of benefits under existing insurance and prepayment plans.

The researchers concluded that hospital management, prepayment and insurance plans, and physicians will be under increasing pressure to provide adequate health services on a nationwide basis.

Under the title "Hospital and Medical Economics" the complete 2-volume, 1,600-page report of the study is scheduled for fall publication by the Hospital Research and Educational Trust, c/o American Hospital Association, Chicago, Ill.

Treatment of Acute Gonorrhea in Males With Synnematin B

BENJAMIN SCHWIMMER, M.D., NORMAN D. HENDERSON, M.D., and B. H. OLSON, Ph.D.

THE INCREASED sensitization of the population to penicillin has posed the need for a new injectable antibiotic, preferably repository, for the treatment of gonorrhea. This antibiotic should be effective in both gonorrhea and syphilis.

Synnematin B, an antibiotic described in 1951 by Gottshall and co-workers (*1*), was shown to be treponemicidal in vitro and in rabbits by Wheeler and associates (*2*), in 1957. In the same year, the successful treatment of a case of primary syphilis was also reported (*2*). The authors have successfully treated two cases of secondary syphilis with the drug. Olson has shown that synnematin B is effective in vitro against species of *Neisseria gonorrhoeae*.

Synnematin B, produced by the mold *Cephalosporium salmosynnematum*, strain 3590 A, is known to be somewhat related to penicillin chemically and in some of its pharmacological properties (*3*). It is inactivated by penicillinase. The toxicity of this antibiotic is extremely low; doses as high as 5 gm. per kilogram of body weight have been given to experimental animals without adverse effects. No evidence of a sensitizing property has been discovered in individuals treated with synnematin B. Attempts to sensitize laboratory animals to the drug have been uniformly unsuccessful. The authors have treated five patients sensitive to penicillin with synnematin B with no adverse reactions (*4*). Berryman and Fisherman have shown that serum reagins to penicillin G or V do not react with synnematin B or penicillamine (*5*). Cowan has discussed the place of synnematin B among drugs used in the treatment of syphilis (*6*).

Because of the marked susceptibility of species of the genus *Neisseria* to synnematin B, a clinical trial of this drug was organized to test its efficacy in the treatment of acute gonorrhea in males.

The present report covers the treatment of 132 cases of acute gonorrhea in males, all with clinically diagnosed urethral discharges and positive smears and cultures. Fermentation tests were done on cultures obtained from most patients on the first visit. All of these tests were positive. The patients were treated with a single intramuscular injection of 300,000 units of synnematin B at the time of diagnosis and were asked to return to the clinic at frequent intervals. The results of treatment of these 132 patients were as follows:

	Number of patients
Negative on followup	112
Discharge present within 30 days	20
Smear and culture negative	3
Smear and culture positive	17

One patient had syncope a few minutes after the injection of synnematin B. The pulse and blood pressure were normal, and he recovered with rest alone. It was felt that he had suffered a vasomotor syncopal episode with no element of allergy. There were frequent complaints of moderate pain upon injection of the drug.

Dr. Schwimmer is director, social hygiene clinic, Detroit Department of Health. Dr. Henderson is coordinating physician, and Dr. Olson is chief, antibiotic and fermentation section, division of laboratories, Michigan Department of Health, Lansing.
The synnematin B used in this study was supplied by the division of laboratories, Michigan Department of Health.

The criteria employed to decide between treatment failure and reinfection were as follows:

- If patients were symptom free and had negative smears and culture 8 days or later after treatment and subsequently developed symptoms and positive laboratory findings, they were considered to be reinfections.
- Patients whose symptoms or positive laboratory tests, or both, persisted or reappeared within 7 days after treatment were considered to be treatment failures.

The first 45 patients treated were asked to return in 24 hours, and 33 of them did so. Twenty-eight patients had no urethral discharge, and smear and culture were negative. Twenty-three were seen on subsequent visits and remained cured for periods of observation ranging from 7 to 31 days, with the exception of one patient who reappeared 31 days after treatment complaining of a reinfection, the symptoms of which had begun a few days earlier. Four patients had a urethral discharge and a negative smear and culture. These patients became symptom-free and remained so without further treatment. One patient had a urethral discharge and a positive smear and culture at the end of 24 hours. Without further treatment, this patient became symptom-free and his smear and culture became negative.

An analysis of the results of followup on the 17 patients who had positive smears and cultures after treatment with synnematin B is shown in the table.

Using the same criteria as above, a comparable study of 100 male patients treated with 1,200,000 units of procaine penicillin in aluminum monostearate showed that 8 percent of the group developed a urethral discharge with positive smear and culture within 30 days. One patient in this group was considered to be a treatment failure and the others, reinfections. This group of 100 patients was drawn at random from patients seen in the clinic during the 2 months preceding the start of this synnematin B study.

Summary and Conclusions

A single injection of 300,000 units of synnematin B was used to treat each of 132 male patients seen in a venereal disease clinic with bacteriologically proved acute gonorrhea. Thirteen percent of this group had a positive

Results of followup of 17 gonorrhea patients with positive smears after treatment with synnematin B

Patient No.	First visit (date of therapy)	Second visit		Third visit		Fourth visit		Results of treatment
		Days since preceding visit	Smear and culture	Days since preceding visit	Smear and culture	Days since preceding visit	Smear and culture	
	1959							
1	September 21	1	Negative	8	Negative	31	Positive	Reinfection.
2	September 22	28	Positive					Do.
3	September 23	1	Positive [1]	37	Negative			Successful.
4	September 23	15	Positive					Reinfection.
5	September 25	5	do					Failure.
6	September 28	4	Negative	14	Positive			Reinfection.
7	September 28	4	do	33	do			Do.
8	September 30	6	Positive					Failure.
9	October 1	8	do					Do.
10	October 1	1	do					Do.
11	October 1	7	Negative	18	Positive			Reinfection.
12	October 2	5	do	38	do			Reinfection. [2]
13	October 5	3	Positive					Reinfection.
14	October 5	3	Negative	7	Positive	25	Positive	Do.
15	October 7	9	Positive					Reinfection. [3]
16	October 7	7	do					Failure.
17	October 9	16	do					Reinfection.

[1] No additional treatment given.
[2] Discharge from reinfection started 8 days after therapy.
[3] Discharge from original infection stopped 2 days after therapy.

smear and culture within 30 days after treatment. Four percent were considered to be treatment failures.

In a comparable study of patients treated with 1,200,000 units of penicillin, 8 percent of the group developed a urethral discharge with smear and culture positive within 30 days. One patient in this group, constituting 1 percent of the total, was considered to be a treatment failure.

Synnematin B is an injectable antibiotic which appears to have great promise in the treatment of gonorrhea. It has not shown any allergenic properties thus far, even in patients sensitive to penicillin.

It remains to be proved if a single injection of 300,000 units of synnematin B will constitute effective prophylaxis against incubating primary syphilis acquired at the same time as gonorrhea.

Further studies will be undertaken to determine whether a higher dose of synnematin B will result in a lower treatment failure rate.

REFERENCES

(*1*) Gottshall, R. Y., Roberts, J. M., Portwood, L. M., and Jennings, J. C.: Synnematin, an antibiotic produced by *Tilachlidium*. Proc. Soc. Exper. Biol. & Med. 76: 307 (1951).

(*2*) Wheeler, A. H., James, K., Lea, W., and Curtis, A. C.: Treatment of primary syphilis with synnematin B; report of a case. A.M.A. Arch. Dermat. 76: 735, December 1957.

(*3*) Abraham, E. P., et al.: Identity of cephalosporin N and synnematin B. Nature 176: 551 (1955).

(*4*) Schwimmer, B., and Henderson, N. D.: Synnematin B in the treatment of syphilis and gonorrhoea; a preliminary report. Brit. J. Ven. Dis. 35: 258 (1959).

(*5*) Berryman, G. H., and Fisherman, E. W.: On modification of penicillin antigenicity. J. Allergy 30: 329, July–August 1959.

(*6*) Cowan, J. A.: Primary and secondary syphilis, current therapy. Philadelphia, W. B. Saunders Co., 1960.

Commentary

A report of the results of a new injectable antibiotic in the treatment of gonorrhea should be timely and valuable to public health workers. Since synnematin B is not readily available, this paper will be of interest principally to laboratory and clinical research workers in the venereal disease field.

Most of the currently recommended schedules of oral and injectable drugs for the treatment of gonorrhea in males reportedly give treatment failure rates ranging from 1 to 12 percent. The principal problem is to establish actual rates on various drug schedules for gonorrhea in females. It is expected that the fluorescent tagged antibody detection method may establish such findings in studies presently getting underway.—W. G. SIMPSON, *assistant chief, Venereal Disease Branch, Communicable Disease Center, Public Health Service.*

Nursing Home Aides Trained

Almost 10,000 nursing home aides have been trained since 1959 through coordinated programs sponsored by the American Red Cross, State health departments, and the Public Health Service. The Red Cross has trained 8,000 aides in 32 States, using volunteer instructors. In the same period, eight State health departments, with consultation from the Public Health Service, have trained more than 100 teachers who have in turn instructed some 2,000 aides. The publication, "How To Be a Nursing Aide in a Nursing Home," was used in both programs.

Problems of the Physical Environment

DAVID V. AULD, B.S.

NOTWITHSTANDING our current international preoccupation with adventures in space, the environment requiring man's primary attention is the earth and its atmosphere. The land on which he builds and the soil which produces his food are no less important than when earthly time began. Water and air are still essential throughout every moment of life.

The total moisture and the total air have remained unchanged since earth was formed. The quantities of water descending on and flowing in our river basins have been substantially constant since the last glacial period, and yet we now hear of shortages. These, then, are not inherent, but manmade.

Fortunately, the changes in our environment have come not from great external forces but from man's own activities. I say "fortunately," because this places the changes within his control if he gains the necessary knowledge and exercises the necessary wisdom.

Water Use

We all fear that sooner or later we, wherever we are, will run out of water. Many accounts of shortages appear each summer, and predictions of future catastrophe accompany each population forecast. There is indeed a water problem, or, more accurately, many problems contributing to our anxiety about the adequacy of future water supplies.

First, let us look at the supply. Over the entire Nation the average 30-inch annual rainfall produces some 4,300 billion gallons daily. Evaporation, percolation, and unregulated runoff reduce the average daily availability to 515 billion gallons (*1*). In the aggregate there are also significant ground water resources, but nobody yet knows how great these may be.

Contrast this with the present overall daily use of 322 billion gallons and the predicted use in 1980 of 494 billion gallons, about 410 billion gallons of which will come from surface sources, and we would appear to be approaching the limit of our supply (*2,3*). Before concluding this, however, these figures deserve some scrutiny.

Those of us concerned with public health naturally think first of domestic water needs on the farm and in the city. The farm requirements, being satisfied almost entirely from ground sources, make no significant drain on the surface flows (*2*). Moreover, it has been estimated that our farm population will shrink to only some 5 percent of our national total, while our urban areas are growing to hold 85 percent of our people.

In 1960 our public water systems used about 22 billion gallons daily with 16 billion gallons daily coming from lakes, streams, and rivers. By 1980 perhaps 25 billion gallons daily will be needed from the surface, and the urban requirement may ultimately reach 85 to 90 billion gallons daily (*2,3*). This is less than one-sixth of the present total average amount available. Certainly then as a Nation we are not threatened with an early death from thirst.

Our present shortages of public water supply are essentially local phenomena. Our people have elected to concentrate in some regions where water resources are meager and in other areas where the resources are sufficient but underdeveloped.

Mr. Auld is director of sanitary engineering for the District of Columbia. *This paper was presented to the Ninth Annual Pennsylvania Health Conference at the Pennsylvania State University, University Park, on August 17, 1960.*

Fortunately, of the more than 1,000 communities, with more than 60 million people, where water rationing occurred in a recent year, the great majority suffered from inadequate facilities for the collection and distribution of water, not lack of water itself. Most municipal water systems have fallen behind the population growth and in the aggregate some $5 billion should be spent to remedy their deficiencies. Moreover, they should be planning new facilities that will be needed within the next 20 years and which will cost another $16 billion (*4*). The challenge here must be met through the use of economic and political means.

So far it would appear that the water essential for life itself is not scarce, and the ways to insure its continued availability are within our control, certainly during this decade and others to come. However, there is strong competition for this precious element because of its unique and irreplaceable qualities for the satisfaction of other needs of man.

Crop irrigation is today and promises to continue to be the greatest single consumptive use of water, now requiring six times the municipal need. We have accepted this practice in the West as a way of life but perhaps have given it scant notice as it has grown in the humid East. Since little if any water so used returns to the streams, it poses a future threat to our city supplies in some localities. In general, the challenge here is to learn and practice improved techniques for the storage, transport, and use of water for irrigation so as to reduce loss and waste. An interesting approach to water conservation has been made in California, where the legislature has before it a proposal to prohibit the use of water for crops which would create or add to marketing problems (*5*).

Water is of course essential to industry, and staggering quantities are used in the production of many items. The growing national economy could automatically add pressures for proportionately greater uses. Industries, however, appear to be able to regulate their needs within wide limits depending on how much water can be had, notwithstanding the general assumptions of shortages to come. There is reason to believe that plant economies and the re-use of water within the plants may reduce future problems (*2*). Prof. Gilbert White, of the University of Chicago, conceded the "water supply clearly is of growing importance in the economic life of market economies," but concluded that "Its part in limiting present or future economic growth in most areas is doubtful" (*6*). A very small part of the water used by industry is consumed. Most of it is returned to the bodies from whence it came, seldom, however, unimpaired in quality.

Steam-operated electric generating plants form the largest remaining category of water users. Here again great quantities are used, only about 1 percent of which is consumed. In some situations even this can be significant. It is estimated that by the year 2000 about 500 million gallons per day will be lost through evaporation resulting from steam generation of electric power in the Potomac River Basin. This is five-sixths of the recorded minimum flow of this river at Washington.

While nearly 500 billion gallons of water will be used daily for all purposes in 1980, consumption will be in the neighborhood of 180 billion gallons daily, of which 148 billion gallons daily will be lost through irrigation. For strictly consumptive purposes therefore, our national supply would appear to be adequate for some time. However, since many of our great population centers are developing without regard for future water availability in their localities, many intense problems will arise. If no significant redistribution of people and industries occurs, our ingenuity will be greatly taxed to make it possible for them to remain where they prefer to be.

About two-thirds of our streamflow occurs during one-third of the year, so much of our water is lost unless stored and released when needed. An additional 100 billion gallons daily can be added to our dependable minimum national supply by flow regulation. It is estimated for example, that the unregulated flow of the Potomac would in a drought fall below the daily municipal water requirements of the Washington Metropolitan Area soon after the year 1970. The challenge, obviously, is to anticipate the shortage and plan now what dams and other structures must be built and where.

Comprehensive development and use of the

water potential of almost all regions will ultimately be essential. Comprehensive development has been defined by Dr. Edward A. Ackerman as ". . . the application of integrated multiple-purpose design, planning, and management which include joint consideration of ground and surface waters, conservational and other measures for 'engineering' of demand, and the treatment, and management of water having substandard quality" (*7*).

Among several of the less obvious of the many considerations which planning for such development entails are:

- Our waters are predominantly interstate, so coordination between the jurisdictions and interests involved becomes an initial challenge. Arrangements between and among the States by compact hold great promise for achievement of this end.
- Basic data as to streamflow and the effects thereon of urban encroachment, as well as various forms of land and forest care and conservation practices, are inadequate for precise forecasting of future stream behavior.
- The extent and availability of ground waters have not been determined to a sufficient degree to reveal their full potential for satisfying future needs. Conversely, the recharge of aquifers, amounting to storing water underground for future use, while a tool of possibly limited application, has had little investigation and use.
- Enormous evaporation losses, especially during storage, pose a problem for which a solution is sought and badly needed. In the west and southwest where losses represent an appreciable part of available water, the problem is quite serious. For example, the annual evaporation from Lake Mead averages 900,000 acre-feet per year, about 16 percent of the water made available by the reservoir (*8*).
- The protection or reservation of sites for future dams and reservoirs before they are preempted by other forms of costly development requires early public action.
- Supplementary or complementary benefits may be hoped for if efforts in weather modification and saline water conversion are successful and applicable on a large scale.

Planning for comprehensive development in its fullest sense must be accelerated during the sixties if we would meet the challenge of future water sufficiency in time (*9*).

Water Quality

Except for irrigation, all water uses competing with municipal supply, and including municipal supply, produce wastes for the disposal of which the waters themselves are necessary. In fact, the capacity of our natural waters to assimilate and transport wastes satisfies one of the greatest of man's needs under present conditions. This constitutes perhaps the most important water use next to domestic supply. Obviously, the presence of contaminants in and the degradation of the waters so used adversely affect their suitability for all other purposes.

Simple dilution, except under some circumstances, can no longer suffice as an acceptable waste-disposal practice. Accordingly, there has been widespread construction of municipal and industrial treatment facilities during this century. Depending on the local conditions, the degrees of treatment provided have been progressively upward. Even so, if no more than the current rate of improvement is maintained, the prospects for our streams are poor indeed. Based on the oxygen-consuming residuals after treatment, it is estimated that the loads reaching our waters from municipal systems in 1980 will be equivalent to the raw sewage from 87 million persons. Industrial waste sources could raise this figure to 174 million (*10*). Against this an assimilative capacity for a population equivalent of only 36 million is available under present conditions of minimum streamflow.

The elevation of water temperatures by industrial use, with power generation being the greatest single category, produces an effect equivalent to organic pollution because dissolved oxygen is lost. Heat in conjunction with otherwise tolerable oxygen-demanding discharges can thus create serious conditions.

Only recently have we become aware of new and comparatively insidious contaminants and organisms for which we are totally unprepared. Their general resistance to current sewage- and water-treatment methods now prompts anxiety. The most conspicuous of these is the synthetic detergent. The synthetic organic chemicals

used as weed, pest, and insect killers, some 500 million pounds of which were produced in a recent year, also find their way into the waters.

These and other so-called exotics, as well as radioactive materials, are appearing in greater amounts. When it is considered that the allowable arsenic content of water is 100 million times greater than the allowable strontium 90 content, it is apparent that even minute quantities of some materials are not insignificant.

The general safety of public water supplies is unquestioned, and the virtual elimination of waterborne pathogenic bacteria during the past 40 years has been spectacular. Had the 1908 death rate from typhoid fever prevailed in 1958, 42,000 people would have died. Instead only 20 died, and I would suppose none of these contracted the disease from well-operated public water systems (*11*). Viruses, however, are now claiming attention, as well as parasitic worms and certain free-living cysts. Current treatment of sewage does not eliminate them and some individuals of the species studied have consistently penetrated the water purification process (*12*). Incidentally, some 70 virus types have been recovered from human feces and sewage.

None of the conventional tests for the control of sewage- or water-treatment processes, nor the considerations in determining stream water quality take any account of these exotics and organisms. The public health significance of these new substances is as yet undetermined. Mark Hollis, Assistant Surgeon General, Public Health Service, has stated: "Even though it is embarrassing, workers in the field simply do not understand the behavior of most of these substances in streams and on water-treatment methods. And even less understood are the health-effect potentials, especially for long-term exposure to low concentrations" (*13*). Obviously, we are here confronted with important challenges which must be met first through research and later through application of the findings. Moreover, if it is determined that the health effects are detrimental, our water and stream standards must be revised and our methods of water-quality assessment improved so as to reveal the true conditions.

Involved with this is the further challenge for the development of water- and sewage-treatment methods which will effectively remove the substances and organisms inimical to health. Here it should be noted that there has been no new basic development in sewage treatment since 1916 when the biologically activated sludge process evolved. Since some mineral and organic substances remain in sewage even after "complete" treatment, the prospect of increasing concentrations of these in streams of our more heavily populated and industrialized areas already justify concern (*13*). At periods of low flow especially, the water in some of our streams and rivers is already re-used several times. A sixfold re-use has been considered as a reasonable future possibility (*14*).

Considering the complexities, solutions are not to be expected overnight. For this reason, we are challenged immediately to make more extensive use of the tools at hand. The degree of sewage treatment by municipalities and industries should be raised as much as necessary to maintain the biological health and aesthetic quality of our streams. And our streamflow should be regulated where necessary to coordinate with such treatment as it is now possible to provide. This combination can do much to forestall early difficulties and might suffice in some situations for many years. All of which brings us back once again to the need for comprehensive water resource planning and development.

Our success through more intensive use of present techniques may suffer, however, from several surprising influences. Our sewage plant effluents are high in nutrients, and our cropland through heavy use of chemical fertilizers is a source of similar materials reaching our waters. Under this stimulation, we may expect to see a heavy increase in algal growth, especially where the streams have been warmed by industrial use. While siltation can smother many of the organisms essential for the biological balance of a stream, the removal of silt with an increase in algal growth induced by the clarified water may add to the problems in some situations (*15*). Tastes and odors in water supplies will increase, and with the death of algae otherwise available dissolved oxygen may be lowered or lost altogether. A future challenge may be to establish control of nutrients in effluents.

It is obvious that each form of water use can, and usually does, have an effect on each other use, and that all uses from both the quantitative and qualitative standpoints must be looked at as a whole. Any such examination, however, must also be made with regard to the regimen of the particular river basin within which it occurs.

Land

The great growth of urban populations has finally been recognized as a breeder of highly complex land-use problems. In one way or another the solutions provided will be of public health significance.

Residents of congested central cities have placed much dependence on the availability of open spaces in the surrounding undeveloped areas. Such spaces are rapidly disappearing. In the Washington area, for instance, new building is consuming 8,000 acres each year. The challenge is to regulate building development so as to insure adequate and accessible recreational opportunities and to procure the necessary lands before they are preempted by other uses.

The shorter workweek, earlier retirement, increased longevity, and generally improved economic status are stimulating pressures for more recreational outlets. Even extensive provisions for recreation within the urban areas will not reduce the need for other substantial acquisitions and developments. In Maryland the number of days, or nights, of camping in State facilities increased from 1,000 in 1950 to 167,000 in 1959 (*16*). Attendance at recreational areas of water resource projects of the U.S. Army Corps of Engineers in 1959 was 106,500,000, a growth of more than 90 million since 1950 (*17*).

Maurice K. Goddard, secretary, Pennsylvania Department of Forests and Waters, stated that we must design recreation facilities close to our population centers. "In building such facilities, however, we face several difficulties. First, very few natural sites exist. Second, since large reservoirs and land areas are involved, there is serious competition between uses . . . uses for highways, airports, shopping centers, housing developments . . . and for each good reservoir site there are a dozen water uses—flood control, water supply, pollution abatement, and so on. This all points to one thing—multiple-purpose reservoirs and multiple use of recreational areas based on these reservoirs" (*18*). All of which brings us right back to our basic challenge to plan for full water resource development, recognizing recreational use as a high-priority consideration in any such system.

One other land problem will be mentioned, one which has received little recognition and attention. Our urban expansion is taking place with no adequate provision for refuse disposal landfills. About 1 acre per year is required for each 10,000 people. As available sites are used and converted to other purposes, more and more remote disposal points must be sought. With each increment of distance comes an increment in cost which adds further to the premium man pays for congested living. The challenge is obvious; the solution is much less clear.

Air

Until relatively recently the air of our cities has received little notice and only the most perfunctory protection, if any, from governmental authorities. The conventional municipal smoke regulations, even if enforced, are generally inadequate and outdated since they seek to control only a few of the sources of air pollution, and to these apply criteria which recognize only a portion of their damage potentials.

Even the nature, extent, and full significance of the various forms of air pollution are largely unknown. The most comprehensive information relates to particulate matter which appears to be in a downward trend, not from controls, but from a change in the sources during the past 30 years (*19*). Gaseous pollution has been studied in comparatively few cities. In general, it would appear to grow in intensity as the cities increase in size.

In addition to the usual industrial sources, the automobile is under some circumstances now recognized as a prime offender. Photochemical reaction between sunlight and volatile organic compounds released through automobile exhausts have resulted in a type of smog in Los Angeles that reduces visibility and has eye-irritating and crop-damaging properties (*20*). It has also been claimed that there is an associa-

tion between the Los Angeles smog and respiratory and cardiac deaths (*21*). Dr. Moyer D. Thomas, senior scientist, department of biological science, Stanford Research Institute, has stated: "Of great concern at this time is the question whether sublethal concentrations of any pollutant in prolonged exposures can cause chronic effects on health or bodily function" (*20*). The challenge here unfolded is for more support of research, both as to the effects of pollutants and the control of their sources.

Just as water problems almost always involve several political jurisdictions, so do those of air pollution. Thus, it is that both investigation and control of air conditions can be adequate only on a regional basis. While this has been recognized in some localities, future success in this field will depend on a high level of interjurisdictional cooperation and coordination. The development of new agencies for this purpose or the addition of new responsibilities to those of existing agencies would justify consideration. This part of the air challenge clearly falls within the political sphere.

With higher concentrations of highway and air traffic, noise is intruding on our urban environment. Of particular concern is the jet age airport both for the workers therein and those who must live nearby. Exposure at close range to jet noise can produce permanent hearing damage (*22*). Of more general importance, however, is the almost incessant, if less intense, sound of aircraft in flight, which frays the nerves, distracts the mind, lowers the efficiency, and tries the disposition. Obviously, the production of noise-making machines has outstripped both our ability and inclination to control them. Within the decade this problem will force its way to a higher position in the public and official consciousness.

Conclusion

The time has passed when we can take our land, water, and air for granted. The time has also passed when we can migrate to new situations where the land, water, and air are unaffected by man's activities. We are now face to face with the consequences of a swelling population whose continued growth and health will be greatly influenced by our ability to insure suitable surroundings. The decade of the sixties will be the time during which many basic decisions must be made and on these will depend our future well-being.

In the fields of public health and sanitary engineering, we are challenged by nearly all aspects of our physical environment, both present and future.

Observation and interpretation as we operate, research and application as we investigate, planning and guidance as we anticipate—all must be used to the full in our response to the "summons to fight."

REFERENCES

(*1*) Research and Education Committee for a Free World: The facts about salt water conversion. Washington, D.C., 1960, p. 6.

(*2*) U.S. Department of Commerce: Water use in the United States, 1900–1980. Washington, D.C., U.S. Government Printing Office, 1960.

(*3*) U.S. Senate Select Committee on National Water Resources: Water resources activities in the United States. Future water requirements for municipal use. Committee Print No. 7. Washington, D.C., U.S. Government Printing Office, 1960, pp. 17–18.

(*4*) Grayson, L. W.: Today and tomorrow in the water supply industry. Willing Water 4: 5–6, June 1960.

(*5*) Analysis of State and municipal legislative and regulatory trends. From the State Capitals. Red Bank, N.J., Bethune Jones, Apr. 8, 1960.

(*6*) White, G. F.: Industrial water use. A review. Geographical Rev. 50: 412–430, July 1960.

(*7*) U.S. Senate Select Committee on National Water Resources: The impact of new techniques on integrated multiple-purpose water development. Committee Print No. 31. Washington, D.C., U.S. Government Printing Office, 1960, p. 2.

(*8*) Langbein, W. B., and Hoyt, W. G.: Water facts for the Nation's future. New York, Ronald Press Co., 1949, p. 49.

(*9*) New York Times, Apr. 10, 1960.

(*10*) U.S. Senate Select Committee on National Water Resources: Water resources activities in the United States. Pollution abatement. Committee Print No. 9. Washington, D.C., U.S. Government Printing Office, 1960, pp. 3–4.

(*11*) Grayson, L. W.: The facts on nematodes. Willing Water 4, March 1960, supp.

(*12*) Berger, B. B.: Public health considerations in municipal water use. Southwest Water Works J. 42: 20–30, April 1960.

(*13*) Hollis, M. D.: Water resources and needs for pollution control. J. Water Pollution Control Fed. 32: 225–231, March 1960, pt. 1.

(*14*) Hollis, M. D., and McCallum, G. E.: Dilution is no longer the solution for pollution. Wastes Engineering 30: 578–581, 638, October 1959.

(*15*) Wolman, A., Geyer, J. C., and Pyatt, E.: A clean Potomac River in the Washington Metropolitan Area. Washington, D.C., Interstate Commission on the Potomac River Basin, 1957, p. 48.

(*16*) Parr, W. A.: Present day trends in State park use. Speech before the Maryland Association of Soil Conservation Districts, July 25, 1960. Processed.

(*17*) Recreational use of water projects rises. News San. Engr. Div. ASCE 86: 14, July 1960, pt. 2.

(*18*) Goddard, M. K.: Recreation aspects of river basin development. *In* Cooperative planning for the Shenandoah Valley. Washington, D.C., Interstate Commission on the Potomac River Basin, 1960, pp. 24–33.

(*19*) Stern, A. C.: Present status of atmospheric pollution in the United States. Am. J. Pub. Health 50: 345–356, March 1960.

(*20*) Thomas, M. D.: New understandings from current atmospheric pollution research. Am. J. Pub. Health 49: 1664–1669, December 1959.

(*21*) Mills, C. A.: Respiratory and cardiac deaths in Los Angeles smogs. Am. J. M. Sc. 233: 379–386 (1957).

(*22*) Transport Workers Union of America, AFL–CIO: ATD–TWU and jet safety. New York.

WHO Assembly Adopts New Resolutions

A budget of $23,607,180 for 1962 was adopted by the 14th World Health Assembly at its meeting in New Delhi, India, February 7–24, 1961. Included in this amount is the $20,852,000 originally proposed by the Director-General, plus additional amounts approved by the Assembly. Two million dollars will be used to finance field activities of the worldwide malaria eradication program and $797,347 for its administrative and operational services costs; $110,033 for assistance to the Republic of the Congo (Leopoldville); and $21,400 for the use of Russian as a working language in the European region.

The new budget reflects attempts to preserve the continuity of WHO's evolution in recent years with particular reference to medical research, the continuing need to concentrate on worldwide eradication of malaria, and the strengthening of basic public health services.

Welcoming the attainment of independence by new states and their entry into the World Health Organization, and stressing the important part WHO has in promoting the right of colonial peoples to freedom and independence through assistance in raising levels of physical and mental health, the Assembly unanimously adopted a resolution appealing to member states of WHO to introduce into or develop in their health education programs the teaching of principles of racial equality and nondiscrimination with a view toward promoting good mental health and in recognition of the fundamental right of every human being to health. The Assembly also adopted a resolution voicing satisfaction with the speedy assistance to the Congo by WHO and requesting similar assistance to all newly independent states who became members of the organization.

In malaria eradication, the cost of field operations in the worldwide campaign will be transferred over a 3-year period from WHO's special voluntary fund to its regular budget. However, voluntary contributions from governments and private sources will continue to be solicited. Beginning in 1961, the cost of administrative and operational services of this program will be financed from WHO's regular budget. These measures will insure that technical achievements in malaria eradication will not be hampered by lack of funds, the Assembly noted.

The Assembly's resolution regarding radiation noted that present scientific knowledge provides data on the harmful biological and genetic effects of massive doses of ionizing radiation. It also recognized the anxiety of member states concerning this hazard and approved the United Nations General Assembly action relating to immediate cessation of nuclear test explosions.

Most countries in which smallpox still occurs have undertaken programs to eradicate it. Progress was reported in worldwide efforts to wipe out smallpox. However the disease remains an important hazard in international travel.

CDC Training Program, 1961–62

Training courses offered by the Communicable Disease Center, Public Health Service, from July 1961 through June 1962 are listed below. This list represents the complete schedule for the period. Courses listed under "Organization and Orientation" are especially developed for people from other countries. Additional information and application forms may be obtained from either the Chief, Communicable Disease Center, Atlanta 22, Ga., or the appropriate regional office of the Department of Health, Education, and Welfare. Applications should be submitted at least 6 weeks before the beginning of each course.

Epidemiology

Principles of epidemiology (101). Jan. 15–19; Atlanta.

Applied and field epidemiology (103). July 6–Aug. 4; Atlanta.

Applied epidemiology (112). Oct. 30–Nov. 3; May 7–11; Atlanta.

Epidemiology for nurses (121). Spring; Atlanta.

Principles of epidemiology for nurses (122). To be arranged; by arrangement with schools of nursing in universities and colleges.

Epidemiology for veterinarians (140). Feb. 19–23; Atlanta.

Vector Control

Epidemiology and control of vector-borne diseases (201). Feb. 12–16; Atlanta; other dates and locations by arrangement.

Insect control, operational (202). By arrangement; Atlanta.

Insect control, advanced (203). Sept. 11–22; Atlanta.

Rodent control, advanced (211). Sept. 25–Oct. 6; Atlanta.

Rodent control, operational (212). By arrangement; Atlanta.

Insect and rodent control (221). June 4–15; Atlanta.

Mosquito control (231). Nov. 6–10; Atlanta.

Identification and biology of arthropods (241). Jan. 8–19; Atlanta.

Environmental Control

Epidemiology for professional sanitarians (308). May 14–18; Atlanta.

Epidemiology and control of foodborne diseases (311). Nov. 13–17; Region VII. June 4–8; Region IX.

Applied procedures for control of foodborne diseases (312). Sept. 18–22; Region VII. Oct. 2–6; Region V. Dec. 4–8; Regions I & II. Feb. 26–Mar. 2; Region IX. Mar. 5–9; Region IX. Apr. 2–6; Region VI.

Venereal Disease Control

Nursing work conferences on the control of venereal disease (421). Dates to be announced; location to be determined.

Nursing in venereal disease control (422). Monthly, September through June; New York City Department of Health, Bedford Health District, John F. Mahoney Training Center, Brooklyn.

Venereal disease contact interview and investigation (431). July 10–21; Aug. 14–25; Sept. 11–22; Oct. 9–20; Oct. 30–Nov. 10; Jan. 8–19; Feb. 5–16; Mar. 12–23; Apr. 9–20; May 14–25; Venereal Disease Training School, Fulton County Health Department, Atlanta. July 10–21; Sept. 11–22; Nov. 27–Dec. 8; Jan. 29–Feb. 9; Mar. 26–Apr. 6; May 21–June 1; Venereal Disease Training School, Detroit City Health Department. Aug. 14–25; Oct. 30–Nov. 10; Feb. 5–16; May 7–18; Venereal Disease Training School, Los Angeles Department of Health.

(For courses given in Detroit and Los Angeles, the first week is for all trainees, and the second week is for experienced personnel only.)

Current laboratory methods in the serology of syphilis (454). Sept. 11–29; Nov. 27–Dec. 15; Mar. 26–Apr. 13; Chamblee.

Management and control of syphilis serology by the central laboratory (455). Apr. 30–May 11; Chamblee.

The *Treponema pallidum* immobilization (TPI) test (456). By arrangement; Chamblee.

Introduction to fluorescent antibody methods (457). Oct. 30–Nov. 3; Jan. 8–12; Feb. 26–Mar. 2; Chamblee.

Fluorescent antibody methods in the diagnosis of the venereal diseases (458). Nov. 5–17; Jan. 15–26; Mar. 5–16; Chamblee.

Darkfield microscopy for the detection and identification of the *T. pallidum* (459). Oct. 9–11; Oct 11–13; Oct. 16–18; Oct. 18–20; Feb. 5–7; Feb. 7–9; Feb. 12–14; Feb. 14–16; Chamblee.

Health Mobilization

Medical program of health mobilization (501). By arrangement; State departments of health.

Health mobilization continua (511). By arrangement; State departments of health.

Training Methods and Aids

Training methods (601). Sept. 11–15; Atlanta.

The preparation and use of training aids (611). Sept. 18–22; Atlanta.

Organization and Orientation

Principles, organization, and practice of communicable disease control (701). Summer 1962; Atlanta.

Applied epidemiology in communicable disease control (712). June 19–July 14; June 18–July 13 (tentative); Atlanta.

Nursing aspects of communicable disease control (720). June 25–29 (tentative); Atlanta.

Environmental aspects of communicable disease control (730). June 12–July 7; June 11–July 6 (tentative); Atlanta.

Laboratory Methods

Laboratory methods in medical parasitology (800). Sept. 11–Oct. 6; Atlanta.

Laboratory methods in medical parasitology (801). Oct. 9–27; Atlanta.

Laboratory methods in the diagnosis of malaria (805). By arrangement; Atlanta.

Laboratory methods in medical mycology (815). Jan. 8–Feb. 2; Atlanta.

Laboratory methods in the study of pulmonary mycoses (817). Feb. 12–23; Atlanta.

Laboratory diagnostic methods in veterinary mycology (940). Mar. 5–9; Atlanta.

Fundamentals of virology (819). Sept. 18–29; Feb. 12–23; Atlanta.

Laboratory methods in the diagnosis of viral and rickettsial diseases (820). Oct. 30–Nov. 17; Mar. 12–30; Atlanta.

Special training in virus techniques (821). By arrangement.

Laboratory methods in the diagnosis of rabies (826). Nov. 27–Dec. 1; Apr. 9–13; Atlanta.

Laboratory methods in medical bacteriology (838). Feb. 26–Mar. 16; Atlanta.

Special problems in medical bacteriology (839). Mar. 19–23; Atlanta.

Typing of *Corynebacterium diphtheriae* (842). By arrangement; Atlanta.

Fluorescent antibody techniques in the public health laboratory (845). Oct. 23–Nov. 3; Atlanta.

Laboratory methods in enteric bacteriology (850). Mar. 26–Apr. 6; Atlanta.

Special problems in enteric bacteriology (851). By arrangement; Atlanta.

Phage typing of *Salmonella typhosa* (852). By arrangement; Atlanta.

Laboratory methods in the diagnosis of leptospirosis (853). By arrangement; Atlanta.

Serologic differentiation of streptococci (854). By arrangement; Atlanta.

Laboratory methods in the diagnosis of tuberculosis (855). Jan. 15–26; Jan. 29–Feb. 9; Atlanta.

Bacteriophage typing of staphylococci (856). Dec. 4–8; Atlanta.

Fluorescent antibody techniques in streptococcus grouping (860). Oct. 2–13; Atlanta.

Serologic methods in microbiology (941). Jan. 29–Feb. 9; Atlanta.

Special problems in microbiology (942). By arrangement; Atlanta.

Clinical Research

The long and close association between the Tulane University School of Medicine and the Public Health Service Hospital at New Orleans is described by Dr. John L. Wilson, recently retired director of the hospital, in the May 1961 *Bulletin of the Tulane University Medical Faculty.*

The hospital and the medical school have exchanged professional services for more than 120 years. At present, 12 of the hospital staff hold faculty appointments at Tulane, and 30 of the Tulane faculty serve as consultants to the hospital.

In recent years, the staffs have worked together in clinical investigations and specialized training programs. The May Bulletin is composed almost entirely of reports on research conducted jointly by the medical school and the hospital.

Federal Publications

Health Statistics From the U.S. National Health Survey.

ACUTE CONDITIONS, seasonal variations, United States, July 1957–June 1960. *PHS Publication No. 584–B24; 1960; 47 pages; 35 cents.*

HERNIAS REPORTED in INTERVIEWS, United States, July 1957–June 1959. *PHS Publication No. 584–B25; 22 pages; 25 cents.*

HEALTH INSURANCE, interim report, United States, July–December 1959. *PHS Publication No. 584–B26; 1960; 67 pages; 45 cents.*

SELECTED HEALTH CHARACTERISTICS, by area, geographic regions, and urban-rural residence, United States, July 1957–June 1959. *PHS Publication No. 584–C5; 1961; 40 pages; 35 cents.*

SELECTED HEALTH CHARACTERISTICS, by area, geographic divisions, and large metropolitan areas, United States, July 1957–June 1959. *PHS Publication No. 584–C6; 1961; 44 pages; 35 cents.*

HOSPITAL UTILIZATION in the last year of life. *PHS Publication No. 584–D3; 1961; 30 pages; 30 cents.*

REPORTING HOSPITALIZATION in the health interview survey. *PHS Publication No. 584–D4; 1961; 71 pages; 50 cents.*

Cancer Services, Facilities, and Programs in the United States, 1960. *PHS Publication No. 14; revised 1960; 166 pages; 70 cents.*

In a new format, this edition of two previous publications lists for each State important advisory and coordinating groups and summarizes legislation pertaining to cancer. It presents for the first time a list of schools of cytotechnology and regional and Statewide registers, as well as approved cancer hospitals and cancer consultation and treatment services.

A summary of each State's program provides information on available funds, public and professional education, detection, diagnosis, and treatment, control of environmental hazards, and special studies.

This booklet replaces "State Cancer Control Programs as Planned for Fiscal Years 1954 and 1955" (PHS Pub. No. 404) and "Cancer Services and Facilities in the United States, 1954" (PHS Pub. No. 14, revised 1954).

Proceedings, The National Conference on Water Pollution. *PHS Publication No. 819; 1960; 607 pages; $2.25*

The complete record of the opening and closing plenary session addresses, banquet speeches, special reports, and panel discussions are included in this report. The panel themes were water pollution and our changing times, meeting the growing competition for water, keeping water clean, and research and training.

More than 30 recommendations resulting from these sessions are also reported.

Radiological Health Handbook. *Order No. PB 121 748R; 1961; 468 pages; $3.75.*

Intended as a basic reference for radiobiology, radiochemistry, and radiophysics students, trainees, technicians, and professional workers whose duties require a knowledge of radiation physics, this handbook is designed to close the gap between the person with little knowledge of radiation physics and the individual who understands and appreciates its complexities.

This revision, which is current to September 1960, supersedes the handbook published in 1957; however, it is similar in scope.

The handbook provides much of the information required in health protection practice. Sections are included on physical, chemical, and mathematical data; radioisotope, decay, and radioassay data; and radiation protection data.

Much of the material has been updated, especially the table of isotopes and the glossary, which has been made consistent with the American Standards Association's Glossary of Terms in Nuclear Science and Technology. Also revised is the chart of nuclides.

The handbook was prepared by the Division of Radiological Health, Public Health Service, U.S. Department of Health, Education, and Welfare. It may be purchased only from the Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C. Order by number. Free sample copies are not available.

Salmonella; Salmonella Infections. Bibliography of literature, 1955–April 1960. *PHS Publication No. 803 (Bibliography Series No. 33); 1961; by Dorothy Bocker; 40 pages.*

Seven hundred and fifty-five references are arranged under the headings: laboratory, animal infections, human infections, and epidemiology. Articles and monographs in English, French, German, Italian, and Spanish are cited, and a few of the entries are briefly annotated. An author index is included.

Russian Drug Index. *PHS Publication No. 814; 1961; 102 pages; 60 cents.*

Drugs developed from 1950 through 1960 in the Soviet Union and those developed elsewhere but carrying new Russian designations are listed.

Six hundred and fifty entries, arranged by subject, include transliteration of the drug name, synonyms, chemical formula, brief description of properties, the Russian bibliographic source, and an American bibliographic source if one was available.

An alphabetical index of drug names including 2,500 synonyms is appended.

University Curricula in Radiological Health. Symposium held at Princeton, N.J., August 2–4, 1960. *PHS Publication (unnumbered); 1961; 132 pages.*

Steps to reduce the national shortage of trained radiological health specialists and support technicians to serve in radiation protection and control programs are highlighted.

Proceedings of a symposium attended by more than 100 representatives of universities, professional societies, governmental health agencies, and others with a principal interest in radiological health are reported.

Qualification standards and educational requirements for specialists in radiological health were the main topics discussed, since the activities and the planning of nearly all schools are still in a comparatively early state.

An inventory lists radiological health courses at 30 universities.

Nursing Home Standards Guide. *PHS Publication No. 827; 1961; 63 pages; 45 cents.*

Developed to assist State and local licensing agencies and other groups interested in instituting or improving nursing home laws, regulations, and ordinances, this publication synthesizes the best features of existing and suggested standards. Major subject areas covered include: development and function of standards, definitions, physical facilities, plant safety, and maintenance and operation of nursing homes.

The guide, written from a national viewpoint, is not intended as a model for adoption without modification. Each State or local jurisdiction must develop its own laws and regulations to meet specific needs and capabilities.

School Health Program. An outline for school and community. *PHS Publication No. 834; 1961; fourfold pamphlet; 5 cents.*

This pamphlet presents in outline form the various aspects and questions which should be considered by community groups and workers interested in improving school health programs. It provides guidelines on how these programs should be measured and strengthened according to present-day resources and requirements. Separate sections deal with health education for pupils, staff, and parents, the school environment related to mental and physical health and safety, and health services within the school and community.

Responsibilities of State departments of health and education are discussed, and the sources of consultation and cooperative assistance are listed. Also included is a selected bibliography on school health policies.

This publication is jointly sponsored by the Public Health Service (Division of Community Practice), the Children's Bureau, and the Office of Education.

Hospital Electrical Facilities. *PHS Publication No. 818; 1961; 35 pages.*

This manual, directed to engineers involved in planning and building hospitals as well as administrators and maintenance personnel, discusses electrical power supply systems, essential equipment, and special installations in hospitals.

Sections are devoted to electrical codes, services, and communication and signal systems. A table on currently recommended lighting in hospitals, illustrations for electrical systems, and a reference list related to electrical power systems are included.

Proceedings: Conference on Physiological Aspects of Water Quality. *Edited by Harry A. Faber and Lena J. Bryson; 244 pages.*

Detailed reports on water quality, minerals, and trace elements in water are made available for the first time. Included also are reviews of the effects of insecticides, pesticides, and other organic substances.

The publication contains contributions from medical specialists, physiologists, toxicologists, biochemists, and biologists.

Single copies are available on request from the Public Inquiries Branch, Office of Information, Public Health Service, Washington 25, D.C.

Register of Air Pollution Analyses, January 1, 1956–June 30, 1959. *PHS Publication No. 610, volume 2; by H. D. Townsend and E. R. Hendrickson; 247 pages; $1.25.*

More than 100 different air sample categories are reported from 400 cities from all 50 States in this listing which supplements the previous volume of the register. Information is tabulated concerning how, where, and when measurements have been made and where results are available.

The register is useful in studies of pollution levels, in epidemiologic studies of the effect of air pollution on health, for comparison of pollution levels in various communities, for determining which sampling and analytical techniques have been used, and for compilation of results of air quality surveys.

Proceedings 1960 Annual Conference of the Surgeon General, Public Health Service, and the Chief, Children's Bureau, With State and Territorial Health Officers. *PHS Publication No. 830; 1961; 60 pages.*

In this official record of the conference appear summaries of discussions on water supply and control, medical care administration, radiological and environmental health, poliomyelitis control, research proposals, metropolitan health planning, and 1960 activities of the Children's Bureau. Recommendations and resolutions of each of the standing and special committees are also included.

Officers and executive committee members of the Association of State and Territorial Health Officers are listed for the past and current years.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared with Federal support.

Unless otherwise indicated, publications for which prices are quoted are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Office of Information, Public Health Service, Washington 25, D.C.

The Public Health Service does not supply publications other than its own.

Information for Contributors

PUBLIC HEALTH REPORTS welcomes from any source all contributions of value to public health.

Most of the readers of *Public Health Reports* are practicing public health officials. About 10 percent of the monthly circulation of *Public Health Reports* goes overseas. About half of the domestic circulation goes to Federal, State, and local government agencies concerned with health and related health interests. A quarter goes to institutions accredited for teaching in health and related fields, to teachers, and to libraries. The journal also reaches research institutions, hospitals, and professional and voluntary public health organizations.

Tearsheets. In lieu of reprints, senior authors are provided with 50 to 100 sets of tearsheets after publication. Associate authors receive a smaller number.

Manuscript review. Manuscripts submitted for publication are reviewed by technical experts, and authors are given the benefit of their comments before type is set. Authors also receive edited typescripts for approval and are given the opportunity to correct galley proofs. Authors are responsible for the accuracy and validity of all material, including tables, charts, and references. Special editorial assistance in preparing or revising manuscripts is available on request, to the limit of staff resources.

Manuscripts are reviewed with the understanding that they have not been committed for publication elsewhere. Appropriate information should be provided if a paper has been given or is prepared for presentation at a meeting.

Manuscript form. Authors will facilitate review and publication if they submit an original and three carbon copies of their manuscripts. All copy should be typed double spaced, and each page should end with a completed paragraph. Of course, several paragraphs may appear on a typed page.

References should be given in the style used by *Public Health Reports.*

Footnotes should be worked into the text or offered as supplemental items.

Authors are expected to recognize scientific contributions by those who have assisted in their papers only if such contributions warrant mention in the text or in the paragraph identifying the authors. It is not the policy of *Public Health Reports* to publish "acknowledgments."

Synopses. Authors are requested to provide a 200-word synopsis of appropriate papers. The staff will supply on request information offering guidance on the preparation of synopses.

Index listings. Public Health Reports is listed in the annual *Cumulated Index Medicus* (American Medical Association), in the monthly *Index Medicus* (National Library of Medicine), in the *Engineering Index,* and in the *Hospital Literature Index.*

Bound copies. Librarians and others should preserve their copies for binding, as the Public Health Service does not supply bound copies. Indexes are published each year in the December issue.

PUBLIC HEALTH MONOGRAPHS, edited and issued by *Public Health Reports,* must be submitted through constituent agencies of the Department of Health, Education, and Welfare.

Most Public Health Monographs are placed on sale by the Superintendent of Documents; series subscriptions are not available. Monographs are not included in subscriptions to *Public Health Reports.*

Address correspondence on editorial matters to: Executive Editor, Public Health Reports, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington 25, D.C.

U.S. GOVERNMENT PRINTING OFFICE: 1961

Public Health Reports, published since 1878 under authority of an act of Congress of April 29 of that year, is issued monthly by the Public Health Service pursuant to the following authority of law: United States Code, title 42, sections 241, 245, 247; title 44, section 220. Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget, August 24, 1960.

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON 25, D.C. 1961

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.
Subscription price $4.25 a year, $1.75 additional for foreign mailing.
Price for a single copy of this issue is 55 cents.

U. S. DEPARTMENT OF
HEALTH, EDUCATION AND WELFARE
PUBLIC HEALTH SERVICE
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF H.E.W.

If you do not desire to continue receiving this publication, please CHECK HERE ☐; cut off this label and return it to the above address. Your name will then be promptly removed from the appropriate mailing list.

PHR